

metal

the news digest magazine

Volume XXVIII-No. 7

July, 1955

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Metals

Review

THE NEWS DIGEST MAGAZINE



VOLUME XXVIII, 7

July, 1955

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Joint ASM-SNT Meeting at Golden Gate



Present at a Joint Meeting of the Golden Gate Chapter and the Northern California Chapter, Society for Nondestructive Testing, Were, From Left: Robert Strother, Guest Speaker; George Hitt, National President, S.N.T.; Victor Walberg, Incoming Chairman, Golden Gate Chapter A.S.M.; and H. A. Archer, Outgoing Chairman. (Photo by Western Machinery & Steel World)

Speaker: Robert G. Strother
Magnalux Corp.

At a joint meeting of the Golden Gate Chapter and the Northern California Chapter, Society for Nondestructive Testing, Robert G. Strother, western district manager, Magnalux Corp., presented a talk on "Present-Day Applications of Nondestructive Testing". George Hitt, national president, S.N.T., was a guest at the meeting.

Mr. Strother discussed nondestructive testing with particular reference to how this method of testing can lower cost and improve the quality of products. The various testing methods were illustrated with a series of slides which showed what could be done to improve the quality of finished products and at the same time reduce over-all costs. Nondestructive testing does not require the sacrifice of actual parts as do other methods of testing.

At this meeting, the Golden Gate Chapter honored 14 of its past chairmen, as well as Frank Drake, past chairman, treasurer for the past 18 years, a charter member of the Chapter and a past national trustee. A plaque was presented to Mr. Drake for his services to the Society.—Reported by G. L. von Planck for Golden Gate Chapter.

Aluminum-Base Alloys Theme of Talk in Quebec

Speaker: G. Marchand
Aluminium Laboratories Ltd.

G. Marchand, Aluminium Laboratories Ltd., presented a talk on "Aluminum-Base Alloys and Some of Their Uses" at a meeting held by Quebec Chapter.

Mr. Marchand mentioned that last

year France commemorated the centenary of the discoveries of Henri Sainte-Claire Deville relating to aluminum. Actually, large-scale industrial production of this metal did not start until 1888. In 70-odd years, the tonnage of aluminum produced has almost reached that of copper, the most common of the nonferrous metals. The remarkable properties of aluminum—lightness, corrosion resistance, strength when alloyed and high electrical and thermal conductivity—have undoubtedly been responsible for this unparalleled achievement.

Outside of the electrical industry, which remains one of the main outlets, the greatest tonnage of aluminum used in Canada and the United States goes into the building industry, mainly for light-alloy roofing, siding and windows. The "curtain wall" is a very spectacular development in the field of architecture.

Use of the stronger aluminum-base alloys is becoming more widespread for bridges, cranes and other structures where ease of erection, increased performance for a given weight and reduced maintenance may be essential or desirable requirements.

The field of transportation appears to be a natural one for aluminum and its alloys. The development of air transport has gone hand-in-hand with that of the high-strength aluminum alloys. Even though the American automotive industry does not use light alloys to any great extent, European achievements in this field indicate remarkable possibilities. Great advantages are claimed for the use of light alloys for suburban and metropolitan rail coaches.

Finally, the field of packaging, deeply invaded in the case of seals, collapsible tubes and foil wrapping,

may see further uses of aluminum alloys for canning following the successful experience of Norway and Switzerland.

Mr. Marchand gave a brief outline of the Canadian system of nomenclature for the aluminum alloys referred to in his talk.

A film showing the fabrication of aluminum at Homestrand, Norway, was presented after the talk.—Reported by J. E. Chard for Quebec.



Compliments

To JOHN P. NIELSEN, incoming chairman of the Chapter, on his appointment as acting chairman of the newly created department of metallurgical engineering at the New York University College of Engineering.

To MONROE SHERMAN, president of the American Silver Co., who received the 1955 American Family Heritage Award, presented annually to the business founder whose success symbolizes the possibilities enjoyed under the free enterprise system, by the Free Enterprise Awards Association, a nonprofit agency devoted to championing the cause of free enterprise, stimulating initiative and combatting totalitarianism.

To YALE UNIVERSITY, on the occasion of its celebration of 100 years of metallurgy on its curriculum. In 1855 the Yale Corp. established a new professorship in the department of philosophy and the arts, to be called the professorship of metallurgy. Thus, for the first time in this country, metallurgy came into being as an area of study meriting inclusion among the academic offerings of a university.

Speaks on Stainless

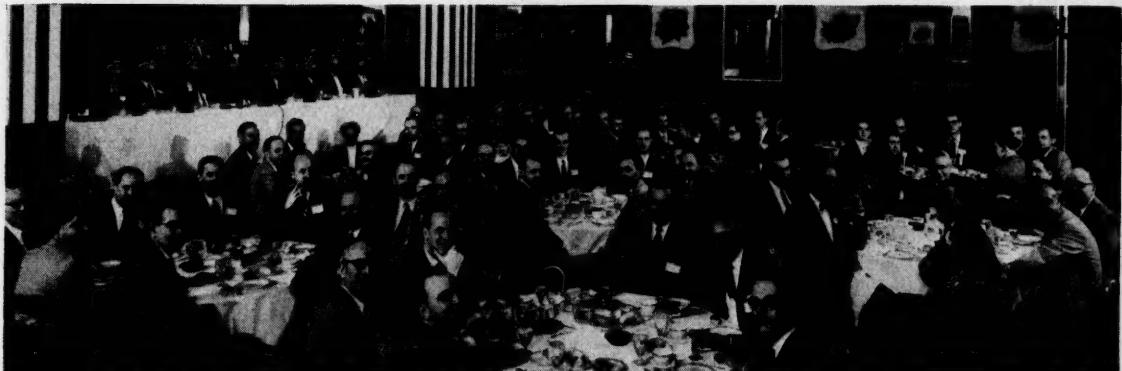


D. C. Buck, Metallurgical Engineer for United States Steel Corp., Is Shown Addressing Northeast Pennsylvania Chapter on "Metallurgical Aspects of Stainless Steel" at a Recent Meeting. (Report by A. Babecki)

At the Lower Lakes Regional Conference

AUG 25 1955

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Show at the Speaker's Table at the Banquet Held During the Lower Lakes Regional Conference, Sponsored by the Buffalo, Ontario, Rochester, Rome, Southern Tier and Syracuse Chapters Are, From Left: W. C. Whealon, Syracuse; National Vice-President A. O. Schaefer; R. P. Griffenhagen, Buffalo, Toastmaster; C. W. Olmstead, Who Spoke on the "St. Lawrence Sea-

way"; W. C. Crafts, National Trustee; Max Howard, Rome; M. N. Hayes, Buffalo; and E. M. Galbreath, Buffalo. Standing behind table are J. L. Lamont and S. M. Brown, Buffalo. In addition to the registration of 184 for the meetings, 47 students from Erie County Technical Institute attended the Conference. (Reported by Raymond P. Griffenhagen for Buffalo Chapter)

Tells How Ultra-High-Strength Steel Is Heat Treated

Speaker: A. R. Troiano

Case Institute of Technology

At a recent meeting of the New Jersey Chapter, A. R. Troiano, head of the department of metallurgy, Case Institute of Technology, lectured on "Heat Treatment of Ultra-High-Strength Steels".

The particular aspect of the performance of steels of strengths in the range of 200,000 to 300,000 psi. concentrated on by Dr. Troiano is a peculiar type of brittle, delayed failure which has occurred in the field. Hydrogen absorption by the structures of these steels associated with such operations as pickling and plating has been determined as being the underlying cause of failure.

The effect of hydrogen absorption upon the characteristics of heat treated 4340 steel has been the subject of recent research by Dr. Troiano and his associates. For their experimentation, sharp notched tensile specimens were used to provide localized failures. A constant amount of hydrogen was introduced in each by electrolytic charging. The amount of hydrogen absorbed was substantially less than that normally introduced by pickling or plating. The variables of experimentation were aging time following charging at room temperature under no stress, and static tensile stress applied. By means of curves, Dr. Troiano showed that as aging time was increased, the stress required for failure increased; hence, aging acted in the direction of strength recovery,

although the quantity of hydrogen introduced would be a governing factor in this respect. A plot of applied static stress against time to failure at constant aging time showed failure to occur between 2 and 7 hr. regardless of the original heat treated strength level of the steel. For each strength level, however, there was a minimum applied static stress which would lead to failure. Dr. Troiano termed this stress the "static endurance limit" of the steel under the conditions being investigated. The static endurance limit was shown to be a direct function of the notch stress concentration factor; hence, for these ultra-high-strength steels so prone to embrittlement by small amounts of hydrogen absorption, in-

telligent designing can raise the static endurance limit.

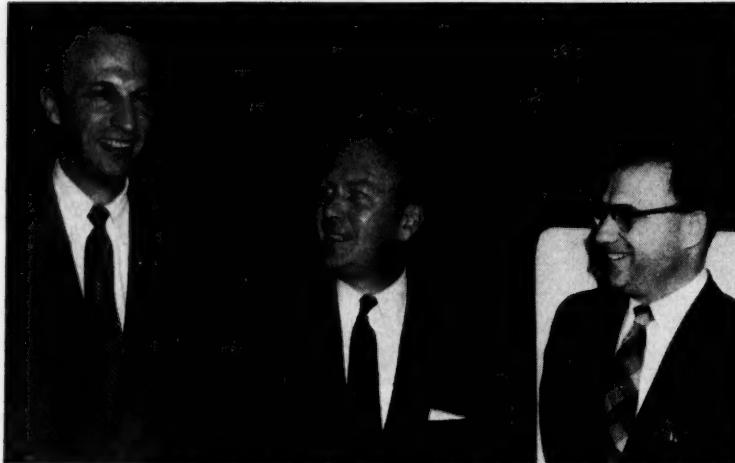
Although Dr. Troiano's work on the subject has been specifically with 4340 steel, all indications are that facts learned with this steel are true for ultra-high-strength steels in general. In summary, Dr. Troiano re-emphasized the sensitivity of these steels to hydrogen, especially since the sensitivity increases with strength level. Once hydrogen is introduced, the potential for delayed brittle failure exists. Baking the steel in the range of 375 to 400° F. or above is usually effective in eliminating this trouble, but this may lower the ultimate strength level.—Reported by R. W. Meyer for New Jersey Chapter.

Chicago Holds Atomic Energy Night



Stuart McLain, Program Coordinator, Argonne National Laboratory, Presented a "Review of the Power Needs of the World" at the Atomic Energy Night Meeting Held by the Chicago Chapter. He predicted what we might expect in the next 25 years in the way of nuclear power plants and described several types of power reactors. Present were, from left: Carl H. Samans, chairman; Frank G. Foote, Argonne National Laboratory; Dr. McLain; J. A. Kubik, Jr., past chairman; and E. L. Roff, past chairman

Selecting Materials for Jet Engines



Andrew G. Slachta, Chief Project Engineer, Development Metallurgy, Curtiss-Wright Corp., Spoke on "Choosing Metals in High-Temperature Jet Engine Applications" in New York. Shown, from left: Herman H. Hanink, Curtiss-Wright Corp.; Walter A. Stadtler, Chapter Chairman; and Mr. Slachta

Speaker: Andrew G. Slachta
Curtiss-Wright Corp.

New York Chapter members heard Andrew G. Slachta, chief project engineer of development metallurgy, Curtiss-Wright Corp., give a talk entitled "Choosing Metals in High-Temperature Jet Engine Applications".

Mr. Slachta described the production of a gas turbine engine from start to finish, discussing the materials needed at each stage. He showed a slide of an assembled jet engine, and presented a detailed description of materials suitable for afterburners.

The temperature gradient which

prevails in such an engine was traced and found to be one of the most important considerations in the choice of materials. But within the framework of such basic decisive factors as temperature and elevated temperature creep resistance and the like, there is room for consideration of factors such as weight and strategic alloy content. Mr. Slachta discussed how the light metals, titanium, as well as stainless steels and the superalloys fitted into this picture, and indicated alternative choices as to metal, which might be made for a variety of components.—Reported by Burton Perlman for New York.

Hartford Chapter Sees Tool Exhibit



At a Joint Meeting of the Hartford Chapters A.S.M. and A.S.M.E., the Connecticut Science Teachers' Association and the Connecticut Personnel and Guidance Association, C. G. Schelley, Managing Director, Wilkie Foundation, Displayed and Discussed the DoAll Co.'s Exhibit, "Civilization Through Tools". Shown are, from left: Robert Meyer, A. S. M. E.; Thomas Hanford, A.S.M. program chairman; Mr. Schelley; David Fisher, A. S. M. E.; Frank Shires, A. S. M. E. program chairman; and A. C. Crownfield, A.S.M.E. (Reported by E. F. Bradley for the Hartford Chapter)

Stresses Importance of New Ideas in Steelmaking At Pittsburgh Meeting

Speaker: W. B. Pierce
Allegheny-Ludlum Steel Corp.

Members of the Pittsburgh Chapter visited the Brackenridge plant of Allegheny Ludlum Steel Corp., which has undergone a \$50,000,000 modernization in the past few years. After the visit, W. B. Pierce, vice-president and technical director, Allegheny Ludlum Steel Corp., spoke on "New Ideas in Steelmaking".

The speaker emphasized the responsibility of technical people to investigate new processes. While careful consideration is required before investigating a new process, failure to follow new ideas results in obsolescence.

The new methods for iron ore reduction, such as the low-shaft blast furnace and solid phase reduction, are now used with certain types of raw materials and under special economical conditions.

The new oxygen refining methods, including the top blown (L&D) or the side blown converter, are important developments and appear to offer a challenge to openhearth steelmaking.

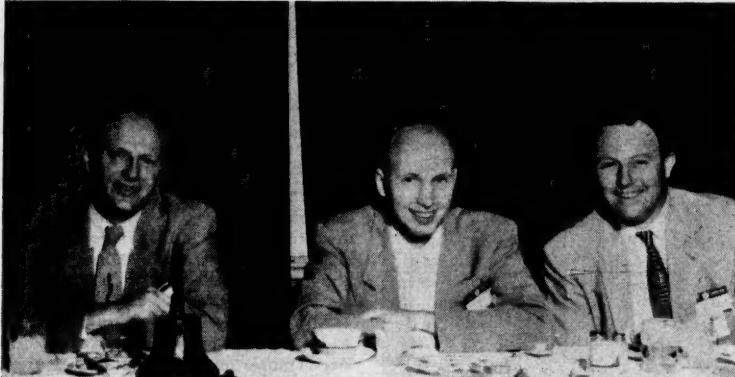
There has been repeated discussion lately on the economics of the electric arc furnace versus the openhearth furnace. Considerable progress has been made in the engineering of the arc furnace which has brought it currently to a competitive stand with the openhearth. If or when the openhearth will be paid the same engineering attention, the economics might change.

There is concrete evidence that vacuum melting improves the high-temperature properties of some high-temperature alloys and the cleanliness of most alloys, and this new method has been rapidly adopted by producers of high-temperature alloys. Induction vacuum melting might not be the final answer to this problem, for the consumable electrode vacuum method could add some further advantages to this process.

In regard to continuous casting, Mr. Pierce spoke about the results obtained at Allegheny Ludlum's pilot plant in Waterbury which has been recently discontinued. The process is feasible from a technical point of view, but the economics of use depend on yield or need for blooming capacity.

The extrusion of steel has become an accepted method for the processing of tubes and other shapes. Alloys which cannot be rolled by other methods and complicated shapes are the main feature of the extrusion method.—Reported by Remus Lula for Pittsburgh Chapter.

Problems of Atomic Energy Explained



D. A. Douglas, Oak Ridge National Laboratory, Spoke on "Materials Problems in Atomic Energy" at a Meeting Held Recently by the Texas Chapter. Shown are, from left: H. C. Dill, past chairman; Mr. Douglas; and A. R. Oakley, Jr., chairman of the Chapter. (Photograph courtesy of Lee Dolan)

Speaker: D. A. Douglas, Jr.

Oak Ridge National Laboratory

D. A. Douglas Jr., in charge of mechanical properties section, Metallurgy Division, Oak Ridge National Laboratory, spoke before the Texas Chapter on "Materials Problems in Atomic Energy". He explained that the work being performed at Oak Ridge is on reactors for production of power and not on atomic weapons.

Slides of the six components of a nuclear reactor, fuel, coolant, control, moderator, radiation shield and structure were shown and explained. Uranium is most generally used as the fuel or source of energy. Coolants include water, heavy water, air, helium and liquid metals such as sodium, potassium and lithium. Shielding materials are tungsten, lead, iron, water, boron, barium and concrete. Moderators are graphite, water, heavy water, hydrocarbons, hydrogen, boron and beryllium. The control rods are made from elements such as gadolinium, hafnium, boron and cadmium.

Mr. Douglas stated that metallurgy, more than any other science, will control the development of nuclear reactors. Structural material should have the following properties:

Stability under thermal stresses; corrosion resistance, reliability; adaptability to remote maintenance; low neutron absorption; freedom from high-activity isotopes; ability to resist radiation damage.

The most important metallurgical problem is corrosion of various types. The structures must also be able to withstand high temperatures. Also, uranium at high temperatures presents quite a problem in corrosion. Some of the metals used in the structures are zirconium, aluminum, stainless steel and nickel-base alloys.

The reactors, when completed, are connected to conventional turbo generators. — Reported by Joe B. Marx for Texas Chapter.

Philadelphia Hears Talk on Continuous Casting Process

Speaker: Isaac Harter, Jr.

Babcock & Wilcox Co.

Isaac Harter, Jr., engineer in charge of continuous casting, Babcock & Wilcox Co., talked on "Continuous Casting" in Philadelphia.

Mr. Harter initiated his talk with slides and a movie and then presented a description of the process. The furnace is at top and metal is poured into a water-cooled brass mold where it freezes into a bar or slab. When the slab reaches a set of pinch rolls it is completely solid.

Babcock & Wilcox's experience with the continuous casting process has indicated that sub-surface quality is the biggest headache. They have found less trouble with the quality of stainless and alloy steels than with carbon steels.—Reported by Frank R. Romeo for Philadelphia.

Try Hand at New Welding Process



Members of the Jacksonville Chapter Try Their Hand With the New Westing-Arc Process During a Visit of the Chapter to the C. I. Capps Co. Foundry

Speaker: F. O. Powell

Westinghouse Electric Corp.

Members of the Jacksonville Chapter visited the C. I. Capps Co. in conjunction with the Georgia Supply Co., the local Westinghouse distributor, to witness a demonstration of the new "Westing-Arc" argon gas process, and to hear F. O. Powell, southeastern representative, Westinghouse Electric Corp., speak on "Mild Steel Inert Gas Welding by the Westing-Arc Process".

Key to the new process, which uses ordinary welding grade argon to shield the arc, is a new coated wire, "Westing-Arc MS-20 wire", a product of a five-year research and development program. This wire produces best results when used with a newly designed welding gun, wire controlled, and a new constant potential power source, the RCP, 500 ampere, d-c arc welder. These new

components, considered separately or as a unit, were reported by Mr. Powell to offer many outstanding advantages in addition to increased speed and decreased costs.

This new consumable electrode process has been used for several years to weld stainless steels, aluminum and other nonferrous metals. Advantages of the process are speed, higher quality and cleaner welds at economical operating costs. It also produces welds without spray or spatter that can be painted without cleaning.

A discussion period followed the talk by Mr. Powell. Many of those in attendance had an opportunity to operate the new Westing-Arc equipment and were amazed at the results obtained after only a few minutes indoctrination. A tour of the C. I. Capps foundry followed the lecture and demonstration.—Reported by H. Huester for Jacksonville.

Speaks on Progressive Stress Damage



From Left: Jack Turbitt, Chairman, J. P. Fowler, Secretary, and Peter Kosting, Watertown Arsenal Laboratory, Who Spoke on "Progressive Stress Damage" Are Shown at a Meeting Held Recently by the North Texas Chapter

Speaker: Peter Kosting
Watertown Arsenal Laboratory

At a meeting held by North Texas Chapter, Peter Kosting, metallurgist, Watertown Arsenal Laboratory, spoke on "Progressive Stress Damage".

Dr. Kosting discussed the history of gun tube manufacturing prior to the Civil War and up to the present, cast gun tubes and their advantages and disadvantages. Breech-loaded and lined cast iron cannon, European-made steel extensions added to cast iron cannon to make them breech loaders and the metallurgical problems involved were also discussed.

Dr. Kosting described the first all-steel cannon, heat checking in the

bore and the high internal pressures encountered. He showed a slide of a ruptured barrel made from tough steel, and one which showed a fragment obtained from a brittle gun tube. Tensile specimens used for testing material for gun tubes were also shown and discussed.

Slides illustrating a study made of a forging at 160,000 psi. and the behavior of a gun tube made from a centrifugal casting and slides showing the brittle and tough behavior of some steels were shown and thoroughly discussed.

Graphs showing the effects of internal pressure on gun tubes were also explained.—Reported by Robert E. Hopper for North Texas Chapter.

Presents Review of New and Standard Types of forgings

Speaker: Eugene C. Clarke
Chambersburg Engineering Co.

Eugene C. Clarke, vice-president, Chambersburg Engineering Co., who spoke at a meeting in Hartford, presented a movie, "Forging in Mid-Air", produced by his company, which describes the Cecomatic process and the impactor, and followed up the movie with a talk entitled "Recent Developments in Drop Forging".

Mr. Clarke reviewed present methods of forging and the improbability of automation in drop forging until a new approach was taken. This was achieved in the Cecomatic process and the impactor, in which die blocks are motivated on a horizontal plane by air cylinders. Material for forging is carried through the operation by overhead conveyor or chain, bringing about true automation to drop forge parts. The primary features of this forging process are lack of vibration, no foundation necessary, a gain in heat during forging and automation.—Reported by E. B. Bartek for Hartford.

New Films

In the Chips

Chase Brass & Copper Co. has released a 16-mm. sound and color film which gives a clear insight into what happens when a tool bites into a free-cutting brass rod, why short chips mean easier machining, smoother and cleaner final surfaces and how proper alloying of the rod in the mill can increase tool life.

Applications for the film should be addressed to Chase Executive Offices, Waterbury 20, Conn., or to nearest Chase warehouse or sales office.

Shell Molding

A 15-min. color and sound film which describes the Link-Belt system of shell molding, which includes a four-station shell molding machine and related conveying equipment to handle sand and resin, a four-station shell closing machine and equipment for handling finished shells through pouring and shakeout.

The film may be obtained by writing to Link-Belt Co., Dept. PR, 307 N. Michigan Ave., Chicago 1, Ill.

Flaw Location With Dye Penetrants

A full color and sound, 23 min., 16-mm. motion picture produced by Turco Products, Inc., demonstrates every aspect of dye penetrant inspection from laboratory theory to authentic production-line techniques. It may be obtained through: Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.

Georgia Host to Aircraft Group



Forrest Yarbrough, Lockheed Aircraft Corp., D. W. Kaufman, Eastern Sales Manager, Rem-Cru Titanium, Inc., and A. F. Sprinkle, Metallurgical Engineer, Timken Roller Bearing Co., Conduct a Question and Answer Period Before a Recent Meeting of the Georgia Chapter, at Which the Chapter Was Host to the Aeronautical Materials Specifications Representatives of the Aircraft Research and Testing Committee in Atlanta Recently for a Five-Day Meeting. Mr. Kaufman and Mr. Sprinkle presented brief discussions on titanium and high strength steels. (Reported by D. Priess for Georgia)

Development, Production And Uses of Zirconium Discussed at Buffalo

Speaker: Stephen Urban
National Lead Co.

Zirconium metal has become an essential structural material for nuclear reactors and its unusual properties can give it a wide range of specialized industrial applications. Stephen Urban, director of research, Titanium Alloy Manufacturing Division, National Lead Co., explained to the Buffalo Chapter how this metal has assumed an important position over the last ten years in his talk entitled "Zirconium, Its Development, Production and Use".

Like titanium, the economical production of zirconium became possible with the development of the "Kroll" process in the 1940's. The extraction chemistries of these two metals are identical but there are practical aspects which make zirconium extraction more difficult. Zirconium tetrachloride is a hygroscopic salt and must be handled carefully. Absorption of moisture causes the formation of complex zirconium compounds which result in higher oxygen content in the reduced metal. Titanium tetrachloride is a liquid and does not absorb moisture from the air.

Because of the low solubility of carbon in zirconium, it can be induction melted in graphite crucibles without serious contamination by carbon. It can also be arc melted, in inert atmosphere, in a water cooled copper crucible. Once melted into ingot, it can be fabricated by conventional means and is available in a variety of forms.

Its low neutron absorption has made zirconium highly desirable for structural components of nuclear reactors and this, at present, is its most important application. Before this came about, however, a method had to be found for separating zirconium and hafnium. Hafnium is present in all commercial zirconium ores and small amounts in zirconium markedly increase its neutron absorption. Separation is accomplished by a solvent extraction process.

Industrial applications are, for the most part, based on the excellent corrosion resistance of zirconium. The chemical industry has found it of value in processes where little or no contamination can be tolerated.

Commenting on its metallurgy, Dr. Urban remarked that, unlike titanium, the oxidation resistance of zirconium cannot be improved by alloying with other metals. Alloying additions, while improving strength, invariably reduce maximum service temperatures in oxidizing atmospheres.—Reported by A. E. Leach for Buffalo Chapter.

Aluminum Extrusions Topic in Canada



Shown at a Meeting Held Recently by the Western Ontario Chapter Are, From Left: L. Kerr, Unifin Tube Co.; J. Tingle, Border Tool and Die Co.; C. G. Robinson, Technical Chairman; H. F. Moorehead, Who Presented a Talk Entitled "Aluminum Extrusions"; and J. Dugal of C. H. McInnis Co.

Speaker: H. F. Moorehead
Aluminum Co. of Canada Ltd.

At a Western Ontario Chapter meeting held recently, H. F. Moorehead, sales development division, Aluminum Co. of Canada Ltd., gave a talk on "Aluminum Extrusions".

Mr. Moorehead traced the history of aluminum extrusions back to the days of the Egyptians and brought it up-to-date with developments to the present time.

In a discussion of the principle of extrusions, Mr. Moorehead stated that the preheated extrusion ingot is held in a heated "container". At one end the container is closed by the die through which the material is extruded, while the other end is closed by a disk with a very small clearance in the container. By applying sufficient pressure to the disk, and thus to the ingot, the metal is caused to flow out through the die.

In direct extrusion the die and container are fixed, while the extrusion ram travels slowly along the bore of the container and the metal is extruded through the orifice in the die. Up to 50% of the applied pressure is used in overcoming the friction between the ingot and the container lining. The container may be movable, or the press may be constructed with a stroke long enough so the ingot can be introduced between the ram and the container.

Good-quality steels are required for dies, backups and die holders; they must stand up under pressures as high as 140,000 psi. at a temperature around 400° C. The 4.5 to 5% chromium or tungsten alloys are being used, and steels running as high as 12% tungsten have been tried but the results did not warrant the higher costs. Chromium-molybdenum steels (7% Cr) have been tried in some plants.

Hollow extrusion ingots are used to make hollow seamless shapes. A mandrel extends through the central opening of the ingot, terminating within an extrusion die orifice. The die orifice controls the exterior configuration and the mandrel controls the interior configuration of the shape.

The impact extrusion process offers unique possibilities in design of aluminum parts, as well as possible cost savings when shells up to 10 in. long and 5 in. in diam. or equivalent bottom area are required.

Mr. Moorehead stated that impact extrusions might be described as cup-shaped parts having cold forged bottoms combined with extruded side walls. They are made in one operation from a cold slug. The bottom can be of practically uniform thickness, or can contain bosses, depressions or ribs. The wall can be almost any symmetrical shape, with or without flutes or ribs, but must be the same throughout the length.

Impact extrusions are produced by striking a high-speed blow with a punch into a die cavity containing a cold slug of metal. The impact is sufficient to cause the metal to fill the die cavity and to flow or squirt upward out of the die and around the punch. On the return stroke, the punch carries the extruded shell with it, which is tripped from the punch when its top edge strikes a stationary stripper bridge.

Investigation of the possibilities of the process is far from ended. Extensive machining operations can be eliminated, and full hard properties of aluminum are developed by the cold working, which makes parts strong and rigid enough for most applications.—Reported by C. G. Robinson for Western Ontario.



1955 Preprint List

*Papers for Presentation at the
National Metal Congress,
Philadelphia, Oct. 17-21, 1955*

All of the following papers will be preprinted for distribution to members of the American Society for Metals upon request. The Society will print only 10% in excess of the number of orders for preprints in the office on press date, and this excess 10% will be sent out as long as it lasts. Order the papers by their numbers before Sept. 1, 1955.

1. Influence of Alloying Elements on the Impact Transition Behavior of 12% Cr Steels Aged at 900° F., by E. J. Whittenberger and E. R. Rosenow, United States Steel Corp.
2. Creep Rupture Properties of Cold Worked Type-347 Stainless Steel, by N. J. Grant, A. G. Bucklin and Warren Rowland, Massachusetts Institute of Technology.
3. Notch Ductility of Type-410 (12% Cr) Stainless Steel, by F. A. Brandt, H. F. Bishop and W. S. Pellini, Naval Research Laboratory.
4. The Influence of Strain Rate and Temperature on the Ductility of Austenitic Stainless Steel, by G. W. Form and W. M. Baldwin, Case Institute of Technology.
5. High Nitrogen Austenitic Cr-Mn Steels, by V. F. Zackay, Ford Motor Co., J. L. Carlson, Hoskins Manufacturing Co., and P. L. Jackson, Misco Precision Casting Co.
6. The Effect of Composition and Structure on the Creep Rupture Properties of 18-8 Stainless Steels, by F. C. Monkman, P. E. Price and N. J. Grant, Massachusetts Institute of Technology.
7. Austenitic Fe-Cr-C-N Stainless Steels, by G. F. Tisinai, J. K. Stanley and C. H. Samans, Standard Oil Co. (Indiana).
8. Effects of Chemical Composition and Heat Treatment Upon the Microstructure and Corrosion Resistance of AISI Types-309 and 310, by D. J. Carney and E. R. Rosenow, United States Steel Corp.
9. Some Effects of Silicon on the Mechanical Properties of High Strength Steels, by C. H. Shih, B. L. Averbach and Morris Cohen, Massachusetts Institute of Technology.
10. Relationship of Torsional Yield Strength to Endurance Limit and Hardness, by Stuart T. Ross, Richard P. Sernka and Walter E. Jominy, Chrysler Corp.
11. The Influence of Molybdenum and Tungsten on Tempered Brittleness, by A. E. Powers, General Electric Co.
12. Hardness of Tempered Martensite in Carbon and Low Alloy Steels, by R. A. Grange and R. W. Baughman, United States Steel Corp.
13. Deformation of Beryllium Single Crystals at 25 to 500° C., by H. T. Lee and R. M. Brick, University of Pennsylvania.
14. Grain Boundary Creep in Aluminum Bicrystals, by F. N. Rhines, W. E. Bond and M. A. Kissel, Carnegie Institute of Technology.
15. Deformation and Fracture Mechanisms of Polycrystalline Magnesium at Low Temperatures, by F. E. Hauser, P. R. Landon and J. E. Dorn, University of California.
16. Influence of Cold Work on Strength of Steel at Elevated Temperatures, by Paul Shahinian, Naval Research Laboratory.
17. Inhibition by Nitrogen of Graphitization in Steel, by G. V. Smith and B. W. Royle, United States Steel Corp.
18. An Approach to the Study of the Effect of Rare-Earth Additions to Steel by Use of Radioactive Tracer Techniques, by O. S. DuMont and J. E. Gates, Battelle Memorial Institute, and C. M. Henderson, Malinckrodt Chemical Works.
19. The Optimum Boron Content for Hardenability, by J. C. Shyne, E. R. Morgan and D. N. Frey, Ford Motor Co.
20. On Banding in Steel, by C. Jatczak, D. J. Girardi and E. S. Rowland, Timken Roller Bearing Co.
21. Notch Ductile High-Strength Nodular Irons, by G. A. Sandoz, H. F. Bishop and W. S. Pellini, Naval Research Laboratory.
22. Fatigue and Anisotropy in Copper, by M. L. Ebner and W. A. Backofen, Massachusetts Institute of Technology.
23. The Influence of Vibration on the Solidification of an Aluminum Alloy, by R. S. Richards, Titanium Metals Corp. of America, and W. Rostoker, Armour Research Foundation of the Illinois Institute of Technology.
24. Nature and Decomposition Kinetics of Alpha Prime in Titanium Alloys, by F. R. Brotzen, Rice Institute, and E. L. Harmon and A. R. Troiano, Case Institute of Technology.
25. Metallography of Tempering of Alpha-Prime in Titanium Alloys, by R. F. Domagala and W. Rostoker, Armour Research Foundation of the Illinois Institute of Technology.
26. Tensile Properties of Zirconium-Chromium Alloys—Particle-Strengthening Effects, by J. H. Keeler, General Electric Co.
27. Progress in the Development of Creep-Resistant Zirconium Alloys, by Walston Chubb, Battelle Memorial Institute.

Presents Welding Discussion in Quebec



At a Meeting Held by the Quebec Chapter, L. D. Richardson, Eutectic Welding Alloys Corp., Spoke on "New Welding Developments". Present were, from left: C. Briercliffe, Canadian Armament Research & Development Organization; Mr. Richardson; G. Letendre, Chapter Chairman; and J. E. Chard, of Canadian Armament Research & Development Organization. Mr. Richardson showed a film describing applications of surface alloying to low-temperature welding methods and one on cutting electrodes

Speaker: L. D. Richardson Eutectic Welding Alloys Corp.

At the last technical meeting of the season, members of the Quebec Chapter heard a talk on "New Welding Developments" by L. D. Richardson, Eutectic Welding Alloys Corp. Forty-four members and guests, including members of the Engineering Institute of Canada, were present at the meeting.

A short film describing applications of surface alloying to low-temperature welding methods and illustrating new types of cutting and chamfering electrodes preceded Mr.

Richardson's talk. The speaker emphasized the importance of welding in the modern world and stressed the spectacular economies often possible in repair and maintenance by the use of welding. Technical advances have been so rapid that jobs impossible to weld even five years ago are now practicable.

A successful welding job involves 90% welding know-how and 10% manipulative skill. The first steps are: Selecting the base metal (usually not possible in repair work), choosing the welding process, selecting the filler and deciding on the welding sequence and procedure.

When considering a maintenance job to be repaired by welding the first step is to identify the base metal, and then to calculate the effect of heat on the part in causing expansion and distortion, formation of hard zones, and the cause of locked-up stresses. Finally, the joint has to be designed and the welding procedure planned. Welds which are otherwise good can be seriously weakened for service by stress raisers such as poor root quality, undercutting, porosity or crater-cracks.

Mr. Richardson described a number of useful welding techniques, including buttering, anchoring, welding in compression, peening for stress relief, preheating for difficult steels and thick mild steel weldments, and sequence welding (back-stepping) methods to avoid the building up of excessive local stresses and to minimize distortion.

The speaker showed a number of slides of difficult welding repair jobs which were successfully carried out, often with startling economies.—Reported by J. E. Chard for Quebec.

Films and Installation of Officers Featured at Phoenix

At the last meeting of the current year, the Phoenix Chapter presented two movies, "Iron-Carbon Alloys" and "Speed Record of the F4D". New officers were installed for the forthcoming season, and the entire group signed a get-well card and sent a bouquet of flowers to Billy Woodside, one of the founders of A.S.M., who is at present bedridden.

The Chapter sends word that Billy would appreciate hearing from his old friends who might have time to drop him a card. His address is: 525 E. Cherry Lynn, Phoenix, Ariz.—Reported by D. A. Rich for Phoenix.

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- 28. Some Effects of Metal Removal and Heat Treatment on the Surfaces of Hardened Steels, by Karl E. Beu, Goodyear Atomic Corp., and D. P. Koistinen, General Motors Corp.
 - 29. Effect of Temperature on Delayed Yielding of Mild Steel for Short Loading Duration, by Joseph M. Kraftt, Naval Research Laboratory.
 - 30. Effect of Tempering Temperature on Stress Corrosion Cracking and Hydrogen Embrittlement of Martensitic Stainless Steels, by Peter Lillys and A. E. Nehrenberg, Crucible Steel Co. of America.
 - 31. Static Fatigue of High Strength Steel, by R. H. Raring and J. A. Rinebolt, Naval Research Laboratory.
 - 32. Rate of Diffusion of Carbon in Alpha and Beta Titanium, by F. C. Wagner, E. J. Bucur and M. S. Steinberg, Horizons, Inc.
 - 33. Hydrogen Contamination in Descaling and Acid Pickling of Titanium, by G. A. Lenning, C. M. Craighead and R. I. Jaffee, Battelle Memorial Institute.
 - 34. Mechanical Properties of Ti-Cr-Mo Alloys as Affected by Grain Size and Grain Shape, by H. R. Ogden, F. C. Holden and R. I. Jaffee, Battelle Memorial Institute.
 - 35. Investigation of the Heat Treatability of the 6% Aluminum—4% Vanadium-Titanium-Base Alloy, by R. G. Sherman and H. D. Kessler, Titanium Metals Corp. of America.
 - 36. Initiation of Discontinuous Yielding in Ductile Molybdenum, by J. A. Hendrickson, D. S. Wood and D. S. Clark, California Institute of Technology.
 - 37. Properties of Vanadium Consolidated by Extrusion, by C. E. Lacy and C. J. Beck, General Electric Co.
 - 38. Mechanical Properties of Vanadium-Base Alloys, by W. Rostoker and A. S. Yamamoto, Armour Research Foundation, and R. E. Riley, Rem-Cru Titanium Corp.
 - 39. Rolling Textures in Tantalum, by J. W. Pugh and W. R. Hibbard, Jr., General Electric Co.



Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review*, published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Creep Testing—Dynamic testing of metals for creep and fatigue at ambient and elevated temperatures has been brought into range of many labs by the development of the EJL-1 dynamic creep-testing machine by the Ivy Co. The unit offers high accuracy, ease of set-up and compactness, plus equal or superior performance to comparable commercial machines.

Electronics Symposium—Stanford Research Institute will sponsor a Symposium on Electronics in Automatic Production jointly with the National Industrial Conference Board in San Francisco Aug. 22-23, 1955. A World Symposium on Applied Solar Energy will be sponsored jointly with the Association for Applied Solar Energy and the University of Arizona in Phoenix, Ariz., from Nov. 1-5, 1955.

Stiffness Tester—A Universal stiffness tester, applicable to dissimilar materials and varying thicknesses, has been developed to measure stiffness and related properties by United States Testing Co.

Circuit Checkers—Peerless Electric Co. has announced its Restorer, a device for correcting inaccurate temperature reading and control caused by circuit failure during heat treating and melting operations.

Porous Aluminum—Porous aluminum and aluminum alloys with controlled ultra-fine pore size are being made by Micro Metallic Corp. The material can be readily formed and welded and has chemical properties equal to those of solid aluminum or comparable alloy composition.

Announce Purchase—Mechanical Devices Inc., Detroit, has purchased the assets of the Peabody Industrial Co., manufacturers of the Peabody portable hardness tester. National representation is being set up in states where industrial activity is highly concentrated.

X-Ray School—North American Philips Co., Inc., will hold X-Ray Diffraction Schools, devoted to lectures, lab work and question and answer sessions on the Basic Principles of X-Ray Diffraction, at the Sir Francis Drake Hotel, San Francisco, from Sept. 26 to 30, and at the Knickerbocker Hotel, Chicago, from Oct. 10 to 14. Information available from Norelco, Mount Vernon, N. Y.

Tear Test—Douglas Aircraft Co. has devised a tear test for titanium sheet which utilizes the Baldwin-Lima-Hamilton 5000-lb. capacity universal testing machine to separate usable quality sheet from rejects. Test also measures quality represented by brittleness, formability and strength factors.

To Build—Construction on a \$1,750,000 research building to house the nation's first private nuclear reactor for industrial research has been started by Armour Research Foundation. The building will also house the Foundation's electrical engineering and physics research department.

Die Castings Booklet—An engineering data booklet on die castings, published by Parker White Metal Co., contains American Die Casting Institute standard specifications, tolerance tables and physical properties of die casting alloys. Copies available from Parker White Metal Co., 2133 McKinley Ave., Erie, Pa.

Anniversary—In recognition of the Golden Jubilee of the Birmingham University Metallurgical Society, a special enlarged magazine will be published in October. Requests may be sent to the Editor, Metallurgical Society, Metallurgical Dept., The University, Edgbaston, Birmingham, England.

Radioactive Hydrogen—Sandia Corp., a division of Western Electric, has completed a series of experiments utilizing radioactive hydrogen to help determine methods of absorption and removal of hydrogen in aluminum casting alloys. Hydrogen gas is one of the deterrents that cause unsightly pin holes and low mechanical properties in aluminum castings.

Pilot-Plant—National Research Corp. has received a contract from General Services Administration to finance construction and operation of a demonstration pilot plant to produce titanium metal by a new non-Kroll process developed by the company.

Atlantic To Build—Atlantic Steel Co. will build an \$8½-million merchant bar and rod mill, the first phase of a modernization and improvement program now underway to increase the company's productive capacity and product range.

Corrosion Course—A five-day course on "Corrosion", sponsored jointly by Washington University, St. Louis and the St. Louis Section, N.A.C.E., will be held from Sept. 12 to 16.

Metal Tubing—Metal tubing is now being formed in a great variety of shapes by a high-speed spinning process in use at Hubbard Aluminum Products Co. By this process it is possible to produce a multitude of shapes which are concentric about the axis of the tube, which, after being spun into basic shapes, can be spun into basic shapes, can be formed or bent to required design.

X-Ray Symposium—A symposium on "Industrial Applications of X-Ray Analyses", sponsored by the Denver Research Institute, will be held from Aug. 11 to 12, at the University Park Campus of the University of Denver, Colo.

Birthday—The American Society of Mechanical Engineers is celebrating its 75th anniversary with a series of special programs throughout the rest of this year.

Super Press—Arnhold Ceramics, Inc., has announced a fully automatic Dorst super press for compacting powdered metal and ceramics. Features of the press include smooth toggle motion with fast approach to die cavity and slow final entry into die, making parts of flawless structure possible.

Research Council—The Corrosion Research Council of the Engineering Foundation, formed with the aid of the American Institute of Mining and Metallurgical Engineers, the Inter-society Corrosion Committee and the Electrochemical Society, has been set up to study the problems of metallic corrosion. Herbert H. Uhlig, chief of M.I.T.'s corrosion laboratory, will head the Council.

Forged Uranium—Uranium, in the form of ingots, is being forged by Heppenstall Co. A 1000-ton capacity press is used to forge the metal by means of V and swage dies. The uranium is heated to the forging temperature in a salt bath and, after forging, the metal is quenched in water to prevent oxidation. Heat treating, when it is required, is also in a salt bath.

Schaefer Speaks on Forging at Philadelphia



A. O. Schaefer, Midvale Co., and Vice-President A.S.M. Spoke on the "Forging Business" at a Meeting Held in Philadelphia. Shown are, from left: Mr. Schaefer; Chairman R. Leiter; and Vice-Chairman J. P. Clark

Speaker: A. O. Schaefer
Midvale Co.

A. O. Schaefer, vice-president of Midvale Co., gave an informative talk on the "Forging Business" at a meeting held recently by the Philadelphia Chapter.

The first significant date in forging history is 1838, when the steam hammer was invented. The forging press came later, originating in England and being introduced in the United States about 1887.

The output of the forging industry is between 3 and 4% of the total production of finished steel products. About two-thirds of total forgings are the product of the drop forging industry. The automobile industry requires one-third of total forging production, all drop forgings.

The industry is divided into two main classifications, the closed die or drop forging industry and the open die forging industry. The closed die industry produces forgings required in quantities and those of smaller size. The open die industry produces the larger forgings and those not required in great numbers.

The raw material for open die forgings is the "forging ingot", which is cast by a relatively small number of steel plants which usually have their own melting facilities. Most closed die forgings remain in so-called "captive shops". The raw material is a billet or bloom, a rolled product produced of standard steels by tonnage mills.

The northeastern quarter of the United States contains over 90% of plant capacity for making forgings in this country. The plants capable of making the largest open die forgings are located within the boundaries of the State of Pennsylvania. Bethlehem, U. S. Steel and Midvale have 14,000-ton presses, the largest steel forging presses in use in the United States.

Mr. Schaefer described the equipment used by both industries. Closed

die forgings are not usually machined by the manufacturer. Open die forgings are almost invariably machined, the machine shop being an essential part of the open die forge shop.

The cyclic nature of demand for products, improved inspection techniques and brittle failures are some of the outstanding problems of the forging industry. Prevention of flakes is more of a problem for the forging manufacturer than any other steel producer.

Recent developments in new methods and new equipment offer further potential improvements in forging manufacture.

Mr. Schaefer presented slides of, and then described large drop forging hammers, Chambersburg impactors, presses which control flow lines, horizontal cylinders on forging presses and the big press program of the Air Corps. He mentioned that cold forging processes are also showing great progress.—Reported by Frank R. Romeo for Philadelphia.



Ralph Leiter (Right), Philadelphia Chapter Chairman, Presents the Metals Man of the Year Award to Francis G. Tatnall, Manager of Testing Research, Baldwin-Lima-Hamilton Corp., During a Meeting Held by the Chapter

Explains Welding Metallurgy of Steels



At a Joint Meeting of the Dayton Chapters A.S.M. and A.W.S., G. E. Linnert Discussed the "Welding Metallurgy of Steels". Shown are, from left: O. B. Reemlin, Jr.; O. B. Reemlin, Sr., the coffee speaker; Major Marking, A. W. S. chairman; H. J. Reindl, A.S.M. vice-chairman; and Mr. Linnert

Speaker: G. E. Linnert
Armco Steel Corp.

At a joint meeting of the Dayton Chapter and the Dayton Section of the American Welding Society, G. E. Linnert, research welding metallurgist, Armco Steel Corp., discussed the "Welding Metallurgy of Steels".

Mr. Linnert dealt primarily with the welding metallurgy of stainless steels, and included an explanation

of plain carbon and low alloy steels in less detail. He reviewed the composition, structure and mechanical properties of the steels to show the importance of these factors and their relationship to each other.

The speaker described the types of problems which are encountered in welding and the metallurgical methods which are used to avoid these difficulties.—Reported by R. A. Koehler for Dayton Chapter.

Committee Formed To Study ASM-SLA Literature Revision

A Committee on Literature Classification has been appointed by the American Society for Metals. The purpose of the committee is to revise and expand the ASM-SLA Metallurgical Literature Classification, working in conjunction with the Committee on Special Classifications of the Special Libraries Association. The personnel of the committee is as follows:

Frank T. Sisco, Director, Engineering Foundation, New York, Chairman.

E. A. Clapp, Metals Research Laboratory, Electro Metallurgical Co., Niagara Falls, N. Y.

F. Forscher, Atomic Power Div., Westinghouse Electric Corp., Pittsburgh.

Laurence S. Foster, Chief of the Reactor Planning Div., Ordnance Materials Research Office, Watertown Arsenal, Watertown, Mass.

C. D. Gull, Administrative Officer, Division of Engineering and Industrial Research, National Academy of Sciences, National Research Council, Washington, D. C.

W. W. Howell, Assistant Editor, *Chemical Abstracts*, Columbus, Ohio.

I. H. Jenks, Head, Publications Division, Aluminium Laboratories, Ltd., Kingston, Ont.

Daniel J. Maykuth, Associate Consultant in Metallurgy, Battelle Memorial Institute, Columbus, Ohio.

E. C. Wallace, Metallurgist, Barber-Colman Co., Rockford, Ill.

T. M. Morris, Professor of Metallurgy, Missouri School of Mines, Rolla, Missouri (Corresponding Member).

Marjorie R. Hyslop, Managing Editor, *Metal Progress*, American Society for Metals, Cleveland, Secretary.

Representing the SLA Committee on Special Classifications:

Frederica Weitlauf, Canton, Ohio.
Allen Kent, Associate Director, Center for Documentation and Communication Research, Western Reserve University, Cleveland.

Two meetings have been held and consideration given to several changes in the classification which will correct some inconsistencies and provide for expansion in some of the newer fields of science. For example, nuclear properties, titanium, and some of the rarer metals have achieved importance in the five years since the classification was first published. Subject breakdowns will be provided for such new fields as these

without disturbing the present framework of the classification to such an extent that existing files will be invalidated.

An expansion of the "Common Variables Index" is also under consideration, along with a re-arrangement of the "Common Elements Index" and the "Materials Index" to eliminate some inconsistencies and provide additional categories.

Opinions, criticisms and suggestions have already been solicited from a large number of users of the system, as well as from experts in various fields of metallurgy. Additional suggestions would be most welcome and should be mailed to the secretary of the committee at A.S.M. headquarters. They will be considered at the next meeting of the committee, to be held during the latter part of September.

Prize Metallographs Complete Tour of U.S.

The best of all entries in the 9th metallographic exhibit at the 1954 Metal Congress in Chicago were sent traveling by A.S.M. early this year. A swing around the circuit from Boston to Los Angeles, to Seattle, to Albuquerque, with 13 intermediate stops, took two large express packing cases to thousands of interested metals engineers.

Over 10,000 express miles were covered by the 400-lb. shipment, which contained nine large panels with their 30 prize-winning micrographs of metal structures.

This is the first such traveling exhibit to be sponsored and sent around the country by an engineering organization.

Tells How Cutting Tools Are Selected



W. E. Bancroft, Chief Metallurgist, Pratt & Whitney Division, Spoke on "Selection of Steel for Cutting Tools" at a New Haven Meeting. Earl Lovering, chairman, is shown offering stubs to Mr. Bancroft (right), for a prize drawing for a free dinner. Fred Storm is an interested observer

Speaker: W. E. Bancroft
Pratt & Whitney Division

W. E. Bancroft, chief metallurgist, Pratt & Whitney Division, Niles-Bement-Pond Co., delivered a lecture on the "Selection of Steel for Cutting Tools" at a meeting in New Haven.

Mr. Bancroft reviewed the material contained in the 1954 Supplement to the A.S.M. Metals Handbook and added numerous examples from his store of experience with cutting tools. Emphasis was placed on the consideration of the items necessary for the economical choice of a proper steel for the end use. These are, in a broad

sense, the tool requirements and manufacturing considerations. Tool requirement considerations involve problems the tool will encounter as regards to wear, toughness and operating temperatures. Under manufacturing considerations, careful thought should be given to availability, cost, machinability, hardenability, grindability and surface treatment.

Mr. Bancroft then explained the method of selection with the aid of the Table of Classification and Identification of Toolsteels. Slides were shown to illustrate how the table could be applied in practice.—Reported by Fred E. Storm for New Haven.

Casting Processes and Applications Described At Cincinnati Meeting

Speaker: H. H. Harris
General Alloys Co.

At a recent meeting of the Cincinnati Chapter, H. H. Harris, president, General Alloys Co., talked on "Revolutionary Advances in Casting Processes and Applications".

Pointing out that the military services are interested in producing high-strength, integrally sound cast components, the speaker, accompanied by slides, showed parts formerly made as forgings and the methods used to produce them. Existing aircraft forgings and fabricated parts were shown redesigned as castings.

Tests in which the redesigned cast parts were simultaneously tested against fabricated or forged parts were described. The cast parts proved to be the stronger even though lighter in weight, an advantage in aircraft work.

Of interest to many of the audience were parts now being cast by high-pressure permanent mold techniques. One part on which tolerances of the order of 0.001 in. in 10 in. were being held was shown. Figures were quoted to prove that this method is capable of being produced in acceptable production rates.

The speaker discussed the casting of aluminum in aluminum permanent molds. Pointing out that the high thermal conductivity of the aluminum mold removes the heat rapidly

yet the mold remains several hundred degrees below its melting point, Mr. Harris stated that this method had been experimentally used in making steel castings. Another example of this same method is the casting of cast iron grinding bells in water cooled copper molds.

Mr. Harris discussed the increasing use of ceramic molds in precision casting work. The use of this mold material aids the strength of casting in that no organics or sands are added that may wash into the metal while still in the molten state. Also, the use of dry molds and cores does not generate steam which might produce deleterious effects upon the casting. A slide was shown of a recently developed machine which will produce ten ceramic molds per minute from re-usable material.

The speaker stated that he believed the merits of the slush casting method have not been fully investigated or exploited. He added that relatively large structural parts can be successfully cast by this process. Points of high stress requiring greater section thickness can be obtained with chilling conductors.

In closing, Mr. Harris pointed out that "castings were born to use." Casting is one process by which it is possible to produce a finished part from basic materials under a single roof. Casting also eliminates using metal where it is not needed or wanted and then having to remove it.—Reported by Gregory F. Baumann for Cincinnati.

Speaks on Marketing at Saginaw



Parker Frisselle (Left), Dow Chemical Co., Gave a Talk Entitled "The Market Is Where You Find It" at a Meeting Held by Saginaw Valley Chapter. He is shown with Chairman R. S. Haverberg. (Photo courtesy Dow Chemical Co.)

Speaker: Parker Frisselle
Dow Chemical Co.

The Saginaw Valley Chapter heard Parker Frisselle, manager of market research for Dow Chemical Co., give a talk on the problems encountered in finding and measuring new markets for industrial and consumer products. His talk was entitled "The Market Is Where You Find It".

Mr. Frisselle explained the difference in conducting research for the industrial and the consumer market. In industrial market research, the factor of human emotions has little or no bearing on the sales of the product. On the other hand, emotions play a very large part in the

buying of consumer goods, that is, goods that are purchased directly by the public. This was illustrated with a discussion on the average consumer's emotional reaction to new products such as Saran Wrap, magnesium batteries and ion exchange resins for water softening.

Consumers can best be sold by something obvious to the senses, he explained. A good example is the emphasis on brighter light rather than longer life for magnesium flashlight batteries. The consumer may be impressed by the first, but never remembers the latter, although the latter would probably be more desirable. — Reported by William Boelter for Saginaw Valley.

Talks on Age Hardenable Alloys at Ottawa Valley

Speaker: W. A. Mudge
International Nickel Co., Inc.

"Commercial Age Hardenable Alloys" was the subject of a talk given by W. A. Mudge, director of technical service on mill production, International Nickel Co., Inc., at a meeting of the Ottawa Valley Chapter.

Dr. Mudge outlined briefly the history of the development of age hardening and some of the theories brought forth to explain the phenomenon.

Some of the base alloy systems covered were those of aluminum, magnesium, zinc, copper, nickel and platinum, and precipitation hardening stainless steels. Dr. Mudge outlined the relative merits of various usable age hardening properties. He discussed graphically the properties, methods of fabrication and general uses of the commercial alloys.

Also discussed were the more complicated age hardenable alloys of the superalloy type in common usage in high-temperature service and the reasons for the development of the more recent ones.—Reported by D. A. Scott for Ottawa Valley.

Old Timers Hear Talk on Tempering



Show at the Old Timers Meeting in Detroit Are, From Left: A. D. Wagner, Secretary-Treasurer; D. V. Doane, Technical Chairman; Morris Cohen, Massachusetts Institute of Technology, Who Presented a Talk on "Tempering of Steel"; V. A. Crosby, Coffee Talker; and Chairman R. D. Chapman

Speaker: Morris Cohen
Massachusetts Institute of Technology

At the "Old Timers Night" in Detroit, ten members received A.S.M. 25-year certificates at a dinner meeting honoring members of long standing. The dinner was followed by a technical program at which Morris Cohen, professor of physical metallurgy, Massachusetts Institute of Technology, presented a talk on the "Tempering of Steel".

Although an "old-time" subject, tempering is the key to newer developments, according to Professor Cohen. He proceeded to illustrate this by reviewing the mechanism of tempering hardened steels. The "constituents" of hardened steel are martensite, retained austenite and residual stress; all these are factors to be considered in tempering. The three stages of the tempering process, (1) the formation of epsilon carbide around subgrains in the tetragonal martensite; (2) the transformation of retained austenite to bainite; and (3) the formation of cementite as the epsilon carbide disappears, were illustrated by a series of excellent electron micrographs. Charts of hardness versus tempering temperature were used to explain the influence of carbon and alloy content on the temperature and extent of the three stages of tempering. When alloys are added, a fourth stage of tempering may occur, due to the formation of a more complex alloy carbide.

After reviewing the mechanism of tempering, Professor Cohen outlined some studies on the mechanical properties of carbon and alloy steels in the hardened condition and after various tempering treatments. The elastic limit of as-hardened steels is surprisingly low, apparently due primarily to "locked in" stresses which cause yielding in isolated local areas within the specimen, and secondarily

to yielding of retained austenite. The elastic limit increases with tempering temperature, reaching a maximum on tempering at 600° F.; as the tempering temperature is further increased, both elastic limit and tensile strength decrease.

Professor Cohen made an important observation that the elastic limit has a possible correlation with the endurance limit. He also showed that the maximum elastic limit can be increased with carbon content and could be achieved at higher hardness levels in higher carbon steels.

Previous studies had demonstrated the potent influence of silicon in delaying third stage tempering. Professor Cohen reviewed some work in which 1.5% silicon was added to 4340 steel. The steel was then studied after quenching and tempering; the silicon-modified 4340 exhibited a high elastic limit at higher tensile strength than did the 4340 without silicon. Acceptable impact values were obtainable at higher hardnesses in the modified steel.

Professor Cohen's talk stimulated an interesting discussion period, in which he elaborated on the influence of time on the tempering process, the mechanism of silicon in retarding tempering and the effect of tempering temperature on the Charpy V-notch impact transition temperature.—Reported by Robert Boswell for the Detroit Chapter.

Outlines Fabricating Properties



Hiram Brown (Left), Chief Metallurgist, Solar Aircraft Co., Who Spoke on "Fabricating Properties of High-Temperature Alloys" at a Meeting in Milwaukee, Is Shown Being Welcomed by Technical Chairman, R. G. Matters, Allis-Chalmers Manufacturing Co. (Photograph by C. K. David for Milwaukee)

Speaker: Hiram Brown
Solar Aircraft Co.

"Fabricating Properties of High-Temperature Alloys" was the title of the talk presented at Milwaukee by Hiram Brown, chief metallurgist, Solar Aircraft Co.

Mr. Brown discussed, with the aid of illustrated slides, the types of failure which can be caused by carbon pick-up, zinc contamination, hot shortness and improper heat treatment. He also elaborated on mill defects, such as laminations and blisters, which can result in splitting and cracking during forming or welding. Grain size was shown to be critical;

very fine-grained materials may develop strain gradients which, at certain temperatures, cause grain growth and cracks in forming operations. The notch sensitivity, rapid work hardening and sensitivity to inclusions in the superalloys require that careful preparation be carried out on assemblies to be welded. Of particular interest was Mr. Brown's discussion of the effect of grain boundary carbide network on fabrication and corrosion resistance of such alloys as type 310 stainless and how Solar Aircraft developed a carbide precipitation chart for 310 austenitic stainless steels.—Reported by E. H. Schmidt for Milwaukee Chapter.

Fracture Under Impulsive Loads Topic at Cleveland

Speaker: John Pearson
U.S.N. Ordnance Test Station

John Pearson, head, warhead research branch, U. S. Naval Ordnance Test Station, spoke on "Fracturing Under Impulsive Loads" at a meeting of the **Cleveland Chapter**.

Mr. Pearson introduced a term he labeled "impulsive loading" to denote the type of loads produced by detonating explosives and impacting projectiles and reserved the term of conventional loading to denote those types of loads produced by present-day test procedures. An impulsive load is usually measured in terms of microseconds and has a pressure magnitude of at least several hundred thousand psi., and more likely, several million psi. The behavior of a metal subjected to an impulsive load is influenced by such factors as temperature, rolling texture and the condition of the material.

In view of the trend to use metals at impact loads of increasing speed and force, knowledge of behavior under such conditions is rapidly becoming essential to the engineer. The nature of impulsive loads causes distortion and fracture patterns which are often unlike those encountered in conventional loading tests. The extreme conditions of loading frequently change the physical properties of most metals, such as causing an increase in their elastic limit, yield strength and ultimate strength. Also,

New Orleans Visits Kaiser Plant



Explaining the Operation of a Nordberg Natural Gas Burning Engine to Members and Guests of the New Orleans Chapter Who Visited the Kaiser Aluminum & Chemical Corp.'s Plant During a Recent Meeting Is Richard Davis of the Public Relations Department. (Photograph by Frank Ransom)

unlike conventional loading, there may be relatively much less distortion of the metal outside a highly distorted localized area which has taken the full impact of the load.

Mr. Pearson discussed the fracturing of plates, rods and tubes under explosive loads and described types of fractures that occur, conditions that lead to these fractures and the effect of the physical properties of the material and the loading conditions on the fracture process. — Reported by J. Skarda for Cleveland Chapter.

During the Ladies Night meeting of the **New Orleans Chapter**, Richard Davis of Kaiser Aluminum and Chemical Corp.'s public relations staff explained the process of making aluminum from alumina at the huge Kaiser plant at Chalmette, La., and showed a color movie "Take a Look at Tomorrow", which illustrated aluminum production from the mining of bauxite to fabrication of mill products.

Following the dinner meeting, the group boarded buses for a trip to the Kaiser plant. An interesting highlight of the tour was a visit to the huge power division, where electricity is produced for the electrolytic aluminum reduction cells. Electricity is generated by means of steam-driven turbines and generators driven by huge gas-burning Nordberg radial engines. Enough electricity is produced in this plant to supply the needs of a city twice the size of New Orleans.

Next stop on the tour was at one of the eight pot lines where cell operations were observed. As the pure aluminum metal is produced by electrolysis of a cryolite and alumina bath it sinks to the bottom of a cavity in the carbon-lined cathode. The metal is tapped by a vacuum siphon inserted through the bath and into the molten aluminum. Crucibles of the liquid metal are transferred to the casting department where it is poured into 1,000-lb. pigs or alloyed with other metals. Over 1,000,000 lb. of aluminum are shipped out of this plant each day.

The tour was concluded with an inspection of the modern laboratory facilities. The main feature of this laboratory is the quantometer where complete analysis of an aluminum sample, with accuracy within $\pm 0.001\%$, can be made in less than two minutes.—Reported by Frank Ransom for New Orleans.

Los Angeles Honors National Officers



Donald S. Clark, Professor of Mechanical Engineering, California Institute of Technology, and Nominee for A.S.M. National Vice-President, Received a 25-Year Membership Certificate During the National Officers Night Meeting of the Los Angeles Chapter. Pictured are, from right: S. R. Kallenbaugh, chairman; Dr. Clark; and A. S. M. Secretary W. H. Eisenman. George Roberts, A. S. M. president, presented a talk entitled "Toolsteels—New Developments and Applications". (Reported by Henry A. Curwen)

Presents Tool Exhibit at New Haven



C. G. Schelly, Managing Director of the Wilkie Foundation, Is Shown as He Presented the Lecture-Demonstration on "Civilization Through Tools" Before a Meeting Held Recently by New Haven Chapter. (Photo by DoAll)

Speaker: C. G. Schelly
Wilkie Foundation

About one million years ago a man picked up a sharp rock to cut an animal hide and, unwittingly, set the stage for his survival and our modern civilization 40,000 generations later. Such tools from the Stone Age, along with a rare assembly of tools from the Copper, Bronze and Iron Ages, and models of the first machine tools, were part of the traveling exhibit "Civilization Through Tools," which was shown to the members of the New Haven Chapter.

Prepared by the Wilkie Foundation, a nonprofit research organization, in cooperation with leading museums and universities throughout the world, the exhibit was presented by the DoAll Co., and presented by C. G. Schelly, managing director of the Wilkie Foundation.

The exhibit presented man's tools in a chronological arrangement to show man's developing intelligence indicated by the increasing complexity of his tools. The first stone tools displayed were descriptive of man at the threshold of progress. They were crude stone implements having no recognizable shape but showing evidence of intelligent use and used for every task at hand. These were followed by stone implements which gave evidence of being deliberately fashioned to obtain sharp edges. Here man's progress suddenly takes a big jump as he decides to fashion tools for a specific purpose, changing the shape accordingly.

Succeeding displays in the exhibit showed how man combined two or more elements to improve the efficiency of his tools by fitting handles to flaked sharp stones to produce axes, spears, etc. One of the most interesting tools was a 10,000 year old "atlatl" or "spear thrower" combining a special socketed handle and spear—probably one of the first "machines" made by man. Ancient sickles

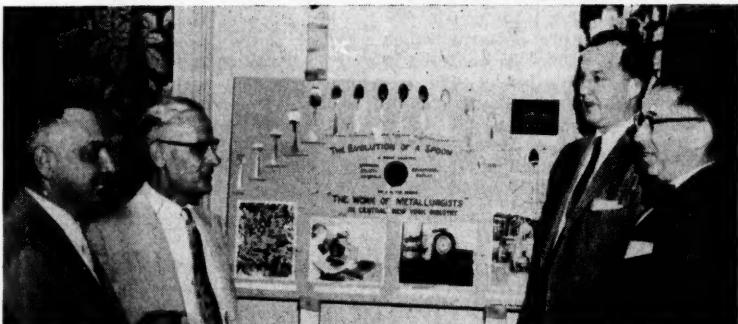
and agricultural implements of wood and stone were also exhibited.

"Civilization Through Tools" then

carried the story of man's evolution through the age of copper, bronze and iron, a period of rapid progress because tools of greater strength and sharpness could be fashioned from metal. Typical tool designs of this era were shown with such tools as an age-encrusted adze, a wood-planing or shaving tool, ancient chisels and axes, etc.

Modern civilization was introduced by displaying exact scale working models of the first "machine tools" that caused the fastest progress in man's evolution. Machine tools freed man from arduous physical exertion since they guided tools by mechanical means and moved the tools by mechanical forces rather than by muscle power. The story of this development, the basis of our modern economy, was augmented in a display panel which described Eli Whitney's concept of mass production through interchangeable parts. This display presented authentic Whitney muskets manufactured under this inspired plan.—Reported by F. E. Storm for New Haven.

Defines Modern Forging Practices



From Left: John F. Pietras, Secretary-Treasurer, Waldemar Naujoks, Who Spoke on "Modern Forging Practice", Ernest E. Grider, Chairman, and John M. Thompson, Vice-Chairman, Are Shown During a Recent Meeting Held in Rome. The exhibit board is the first in a series being prepared by the Chapter as part of its educational program. (Photo by Utica Daily Press)

Speaker: W. Naujoks
Globe Forge, Inc.

Waldemar Naujoks, vice-president and general manager, Globe Forge, Inc., discussed "Modern Forging Practice" at the annual meeting of the Rome Chapter.

Tracing the history of metal forging from the early days of hand forged swords and armor when the art was passed from father to son, to the present day when 35,000 and 50,000-ton presses are nearing completion, Mr. Naujoks emphasized that the art has definitely become a science in the past few decades.

During this period of transition, the advent of water power, and later steam power, enabled the development of heavier trip hammers and forging presses. Knowledge gained in the handling of many metals, both ferrous and nonferrous, has resulted

in the development of techniques which have brought the forging industry to a key position in the nation's economy.

Cited as one case where forging has been of vital importance was the fact that the final decision of the war between the States was in great part due to the weapon superiority of the North which had production facilities for the drop forging of parts for weapons.

The speaker illustrated his lecture with slides which demonstrated the high degree of efficiency possible in forging practice where maximum strength for given volume of material is required and machining is held to a minimum. Typical examples included crankshafts and connecting rods for engines, plumbing fixtures, high-pressure valves, etc.—Reported by Joe B. Marx for Rome Chapter.

Panel on Heat Treating of Steels Answers Queries At Meeting in Springfield

At a meeting of the Springfield Chapter, a panel of experts answered questions on the "Heat Treating of Steel", following the showing of the A.S.M. 16-mm. sound movie entitled "Heat Treatment of Steels". The panel consisted of Howard Boyer, American Bosch Arms Corp., Paul Farren, Hartford Machine Screw Co. and Fred Whipple, New England Metallurgical Co. A few of the interesting questions and answers are given:

Q. How can distortion be avoided in a deeply slotted part made of oil-hardening steel?

A. Use a fixture; don't cut the slot all the way through, but leave a web for support and remove the web after hardening; shift to an air-hardening steel; use a martemper rather than a conventional quench.

Q. When a customer requests a high speed steel punch be hardened to Rc 58, should the part be underhardened or overttempered?

A. Convince the customer he should specify a higher hardness. If unsuccessful in this attempt, probably underhardening is the best procedure.

Q. What is the value of double tempering?

A. Double tempering does two things: It gets rid of most of the retained austenite resulting in more effective use of steel and, more important, it tempers the martensite formed from retained austenite following the first temper, hence improving toughness.

Q. Could anything be gained by quenching from the first temper?

A. The time saved is of negligible importance when compared with the danger of cracking.

Q. Do the alloying elements have any appreciable effect on the properties of martensite?

A. No. The alloying elements are of greatest importance as they affect the ease of hardening or hardenability.

Q. What happens when mill bark is not completely removed?

A. Cracking is likely to occur, or a piece having inferior surface hardness, surface strength and fatigue strength will result. On a 5 in. round, a cut 3/16 in. deep is recommended for complete removal of mill bark.

Q. Can you recondition a decarburized surface by carburizing?

A. Carbon restoration can be accomplished but involves the dangers of over or undercarburizing. It is better to remove all of the decarburized layer, that is, all of the metal having a lower carbon content than the core.—Reported by Carl A. Keyser for Springfield Chapter.

Presents Talk on Brazing Metallurgy



A. S. McDonald (Left), Handy & Harman, and E. Chalmers (Center), Technical Chairman, Talk Over a Problem Brought Out in Mr. McDonald's Talk on "Brazing Metallurgy" With a Member of the Audience in New Haven

Speaker: Allen S. McDonald

Handy & Harman

Allen S. McDonald, research metallurgist, Handy & Harman, presented a talk entitled "Brazing Metallurgy" at a meeting held in New Haven.

In any brazing operation the quality of the resulting braze is a function of many factors, some of which have their source in the nature of the base metals, some in the nature of the environment during brazing and some in the nature of the filler metal.

Confining his attention to the factors which can be related to the metallurgical constitution of the metals involved, Mr. McDonald discussed the flow characteristics of brazing alloys. The flow characteristics of any filler metal are directly related to the composition of the alloy and the phase diagram of the system involved. Filler metals which are elemental substances or eutectics have one discrete melting temperature above which they are completely liquid and fluid. Filler metals which are completely eutecticiferous, such as a silver-copper-zinc-cadmium alloy whose composition is such that it consists completely of pseudo-binary silver-copper eutectic in the multicomponent field, will have a very narrow melting range and approach eutectics and elemental substances in their behavior. Other filler metals will in general have a melting range in which they are more or less liquid, depending on their constitution and composition.

It is in these latter alloys that the problem of liquation arises. That is the separation of the liquid phase from the solid phase when the alloy is heated through the melting range. When this happens the solid "skull" remaining behind has a different composition from that of the original alloy and thus different characteristics, particularly liquidus temperature.

Such alloys have a definite advantage in some applications but care must be taken to use them under conditions where liquation will not occur, by heating the assembly rapidly to the brazing temperature.

Another factor in brazing related to the metallurgical nature of the metals involved is the extent of interalloying between filler metal and base metal. Silver-base alloys have a definite advantage in brazing ferrous metals in that there is negligible intersolubility between base and filler metal. However, a silver-base alloy has not to date been developed with sufficient oxidation resistance for use in brazing heat resistant alloys for high-temperature service. Most high-temperature brazing alloys now being used for oxidation resistance are nickel-base alloys. Considering the intersolubility of iron, chromium and nickel, it is not surprising that such alloys react with heat resistant base metals. The problem is greatest in production brazing heat exchangers and "sandwich" type structural elements out of light-gage stock where the reaction may penetrate the thickness of the material.

Mr. McDonald showed examples of new brazing developments, including ceramic-to-metal joints made with Handy & Harman's titanium cored BT, and graphite-to-metal joints made with experimental alloys developed in Handy & Harman's research laboratories.—Reported by F. E. Storm for New Haven.

has inaugurated a summer employment bureau available not only to the student Junior members of the **S** but to all students in all engineering schools in the United States and Canada, listing the available jobs and giving complete information and instructions.

IHEA Panel Members at Metal Show



Industrial Heating Equipment Association Sessions Held in Conjunction With the Western Metal Congress and Exposition in Los Angeles Included the Above Panel Members Who Spoke on "Aluminum and Magnesium". They are, from left, seated: D. W. Pettigrew, Swindell-Dressler Corp.; G. F. Rucker, Leeds & Northrup Co.; Bernard P. Planner, A. F. Holden Co.; and W. J. Parsons, Pacific Scientific Co. Standing, from left, are: B. E. McArthur, Magnethermic Corp.; and Horace Drever, Drever Co. Approximately 175 persons attended this interesting session

Will Conduct Titanium Metallurgy Course at NYU

The department of metallurgical engineering of the College of Engineering, New York University, and the Office of Special Services to Business and Industry, in cooperation with the newly-formed A.S.M. Metals Engineering Institute, will conduct a one-week course on the metallurgical problems associated with titanium.

The titanium metallurgy sessions will be held Sept. 12 to 16, 1955, at the University Heights campus, New York University, College of Engineering, Bronx 53, New York. Three lectures will be given each morning from 9:30 to 12:30 and two afternoon lectures from 2:15 to 4:15. Informal evening discussion sessions are also being planned.

Experts in various phases of titanium metallurgy will present a total of 25 lectures in their particular fields. The course will cover extraction, melting, purification, physical metallurgy, alloying, heat treatment, mechanical metallurgy, analysis, corrosion, fabrication problems and applications.

The following will be the schedule of lectures and laboratory sessions:

Monday, Sept. 12, Applications and Melting; Tuesday, Sept. 13, Physical Metallurgy—Phase Diagrams, Metallography and Alloying; Wednesday, Sept. 14, Heat Treatment and Properties; Thursday, Sept. 15, Mechani-

cal Metallurgy, Corrosion and Fabrication; Friday, Sept. 16, Fabrication and Extraction.

Enrollment fees will be \$90 for the entire course or \$30 per day. Attendance will be limited. Registrants

for the entire course will have priority over one-day registrants.

Dormitory space will be available from Sept. 11 to Sept. 17 for those requiring it, at a rate of \$2.50 per day.

A brochure giving the details of the five-day program together with the necessary registration forms may be obtained by writing to:

Dean Wilbur McKee
6 Washington Square, North
Gallatin House
New York University
New York, N. Y.

Registration forms should be returned no later than Aug. 20, 1955.

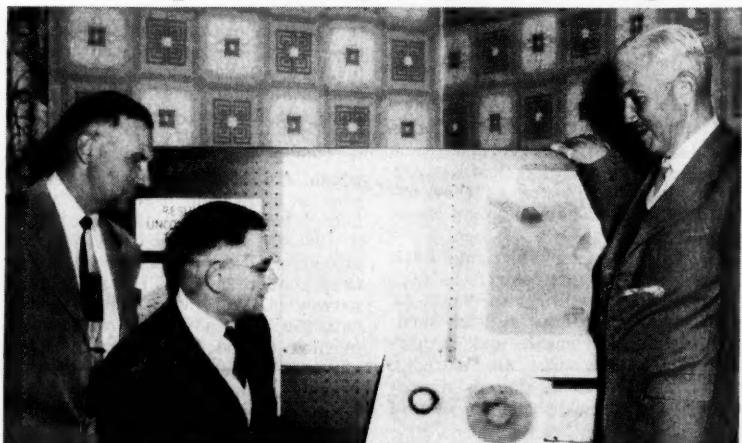
Manitoba Chapter Will Sponsor University Course

The Manitoba Chapter will sponsor an extension course at the University of Manitoba in "Physical and Mechanical Properties of Steel and Aluminum", in conjunction with the University Department of Extension and Adult Education, during the month of October 1955.

The course will consist of eight lectures and practical demonstrations. It will be conducted on a level which will be attractive to, and informative for, all supervisory and shop personnel in the metals industry.

The Chapter is subsidizing the major portion of the cost of this course as a contribution to Manitoba's metals industry. If the course is filled to capacity, no additional fee other than the \$10 enrollment will be required; if not, an additional charge, not to exceed \$5, will be payable at the first lecture.

Sums Up Advantages of Strain Gages



Francis G. Tatnall, Manager of the Testing Research Department, Baldwin-Lima-Hamilton Corp., Presented a Talk on "Newest Things in Testing" at a Meeting Held by Rome Chapter. Mr. Tatnall explained that with the strain gage, stronger structures, better design and lighter weight can be achieved. Shown are, from left, Max Howard, chairman; R. C. Gibbons, program chairman; and Mr. Tatnall. The A. S. M. traveling metallographic exhibit was on display at the meeting. (Reported by J. M. Thompson)

Symposium on Atomic Energy in Metals Industry at Toledo

The Toledo Chapter has recently concluded a symposium on "Atomic Energy in the Metals Industry". The course was presented in cooperation with the University of Toledo.

Speakers and their subjects were:
Basic Principles in the Use of Radio-Isotopes, by A. E. Focke, manager, materials development, aircraft nuclear propulsion department, General Electric Co.

Application of Radio-Isotopes to the Metals Industry, by C. E. Crompton, assistant director, isotopes division, U. S. Atomic Energy Commission, Oak Ridge.

Role of Metals in the Atomic Energy Industry, by Frank G. Foote, director, metallurgy div., Argonne National Laboratory.

Nuclear Weapons and Atomic Power in the Future, by W. H. Johnston, department of chemistry, Purdue University.

Dr. Focke presented an elementary review of the basic concepts of nuclear particles, their combination into elements and isotopes, the reactions of radioactive decomposition and the effect of radiation on various materials. His talk served as an introduction and provided background for the other parts of the Symposium.

A discussion of the basic particles was limited to the generally accepted electron, positron, proton, neutron and gamma rays. The combinations were described in detail for the isotopes of the simpler elements and for carbon and iron which are of primary concern to most metallurgists. Attention was given to the natural radioactive elements and to the methods of producing radioactive isotopes by particle bombardment and fission neutrons.

A simple Geiger tube unit and scalar was used to demonstrate how radioactivity can be measured. Illustrations of more elaborate proportional, scintillation and electronic counting were shown.

Brief mention of the major hazards incident to the handling of radioactive materials was made, and units of radioactivity and of radiation effects were defined.

The talk concluded with a concise summary of the general effects of radiation on metallic and organic materials.

Dr. Crompton's discussion covered the broad import of the radio-technique to the metals industry and details of those singular accomplishments that have brought this new tool to the forefront of metallurgical research and metals testing.

The past eight years of the isotopes distribution program have seen applications of radio-isotopes in virtually all phases of the metal in-

Presents Award to Yale Student



John Hunsicker (Center), Yale University Metallurgy Student, Is Shown Receiving a Student Award From E. Lovering, Chairman, New Haven Chapter. At left is Arthur Philips, Professor of Metallurgy, Yale University

dustry, beginning with the flotation of minerals and progressing through the sciences of steelmaking to the evaluation of properties or performance of the final metal product.

Metallurgists have at last been furnished a technique that permits them to study with ease the self diffusion of metals, the mechanism of corrosion and surface effects, the subtle effects of wear processes and electrolytic deposition. The approach to and results of typical investigations were described, together with some common sources of error and limitations of this technique.

In all radio-isotope work, health and safety considerations are of paramount importance. Time was devoted to aspects of radiological safety pertinent to metallurgical types of investigation. Laboratory design considerations of health and safety for a tracer radio-isotope program were reviewed briefly.

Dr. Foote presented a summary of problems encountered in finding suitable materials for reactor construction. He outlined the conversion of U^{238} to Pu^{239} , with its subsequent decay to U^{235} , and the conversion of Th^{232} to U^{233} , emphasizing the considerable amount of heat evolved.

The amount of heat given up in the fission of a single gram of U^{235} is equivalent to approximately 22,700 kw-hr. This heat must be dissipated from the reactor and the structural members of the reactor must be made of materials which are not readily corroded by the coolant used. Further, if the coolant or the structural members of the reactor absorb more than their 1.5 neutron share of the 2.5 neutrons per fission, the fissioning will come to a stop.

Dr. Foote gave a brief resume of the Argonne reactors #4 and 5 and described broadly the materials of construction used in each.

Summarizing, Dr. Foote stated that the metallurgist would find his work of increasing importance in the atomic energy field, particularly as the emphasis shifts to portable nuclear reactors.

Dr. Johnston indicated that European countries are more logical areas for immediate future use of atomic power, due primarily to their peculiar fuel problems. He described test reactors and power plants and illustrated his talk with slides.

He then took up weapons, and after pointing out that he was limited in what he could say, he showed part of a new Civil Defense film which illustrated preparation for and explosion of the first thermonuclear device. He emphasized that radioactivity, especially in inland lakes such as Lake Michigan, and at high altitudes, such as at Denver, has always been with us. Compared with average fallout from test explosions and allowable radiation from A. E. C. operations, it was apparent from what Dr. Johnston said that fallout and average radiation therefrom resulting from test use of nuclear devices was probably insignificant as compared to the benefits which are obtained from the tests.

The Metallurgical Advisory Board has designated γ as the medium through which information relative to metallurgical problems may be transmitted to the profession.

Presents Talk on Surface Hardening



Michael Bever (Right), Department of Metallurgy, Massachusetts Institute of Technology, Who Spoke on "Surface Hardening", and Henry Inouye, Technical Chairman, Are Shown Prior to a Meeting of Oak Ridge Chapter

Speaker: M. B. Bever
Massachusetts Institute of Technology

Oak Ridge Chapter members heard Michael Bever, associate professor, metallurgy department, Massachusetts Institute of Technology present a talk on "Surface Hardening" at a recent meeting. Dr. Bever put particular emphasis on the principles of nitriding and carbo-nitriding.

As a general introduction, an outline was presented which enumerated the various hardening processes, such as cold working, alloying, quenching and age hardening, together with a brief discussion of each with respect to the mechanism by which the desired hardness is attained. Some mention was made of the two primary objectives of surface hardening, namely, to increase wear resistance, and to increase fatigue resistance. Surface hardening processes were compared with the alternative of making the entire piece hard.

Detailed consideration was given to the process of carburizing, which consists essentially of supplying carbon at the surface of the work-piece above the transformation temperature, the precise temperature limits being governed by the considerations of grain growth and furnace economy. One of the complicating factors stressed was that encountered in heat treating the piece, namely, that it is necessary to heat treat the case and the core simultaneously.

The second part of Dr. Bever's discussion was devoted to the closely related processes of carbo-nitriding and cyaniding. He indicated that

these processes may be regarded as carburizing with the addition of nitrogen as an alloying element, the essential difference being that the former is carried out in a gaseous system, while the latter involves molten salt baths, or liquid systems. In specimens treated by these methods, he showed that the alloyed nitrogen acts in much the same manner as alloyed nickel in that it leads to increased hardenability and a lower transformation temperature.

The main process variables in carbo-nitriding were shown to be the dew point and the ammonia content of the gas in the system, and subsequent slides presented data showing the quantitative effects of changing these variables.

Other slides showed Jominy test data for carbo-nitrided and carburized specimens, photographs of hardness indentations on surface hardened specimens, and the actual microstructures of specimens treated by the processes discussed. Particular emphasis was placed on a photomicrograph of a carbo-nitrided specimen in which were visible two distinct layers at the edge and a second photomicrograph which showed the variation in the quantity of retained austenite from edge to center of a carbo-nitrided sample.

Consideration was then given to the process of nitriding. This is a gaseous process in which the nitrogen is provided by the dissociation of ammonia at the gas-solid interface. Hardening results from the precipitation of nitrides such as aluminum or chromium nitrides and

steels for nitriding must contain aluminum or chromium. In contrast to the previously discussed methods, it was indicated that nitriding involves no quenching, low temperatures, and a comparatively long treatment time.

To conclude his lecture, Dr. Bever described three typical applications which might be encountered in practice. Work-pieces of a certain nature were to be subjected to specified service conditions of wear, corrosion, and the like. He then requested the members of the audience to test their comprehension of his lecture by choosing the optimum core material and surface hardening technique for each application.—Reported by Robert Potter for Oak Ridge.

Developments in Aluminum Outlined at Jacksonville

Speaker: A. W. Hess
Reynolds Metals Co.

At a meeting of the Jacksonville Chapter held at the Jacksonville Metals and Plastic Co., A. W. Hess, regional technical engineer, Reynolds Metals Co., spoke on "New Developments in Aluminum and Aluminum Alloys".

Mr. Hess gave a brief history of aluminum, from its isolation as an element in 1825, through present production methods for producing aluminum and aluminum alloys, including 99.99% pure aluminum.

Growth of the aluminum industry from 1939 through 1954 increased 815% and is expected to increase by 1000% by the end of 1955, whereas steel increased only 67%, copper 48%, lead 11% and zinc 61% from 1939 through 1954.

The reserves of bauxite as well as future ores and other raw materials used in the production of metallic aluminum were discussed. Several of the newer alloys and applications, such as X5055 and 5154, which give excellent strength and weldability, and the new high-strength heat treated alloy C7178 were also discussed.

Aluminum's many economic advantages were stressed, including its light weight, ease of fabrication, resistance to corrosion, high strength in alloys, high electrical and thermal conductivity, high reflectivity, low emissivity, nonsparking, nonmagnetic and nontoxic characteristics, appearance, high scrap value and low modulus of elasticity.

Future large tonnage applications of aluminum and its alloys in the automotive, architectural, light poles and standards fields were described.

Prior to the meeting, members toured the Jacksonville Metals and Plastic Co. plant where products manufactured for industry and for the government were seen in all stages of manufacture.—Reported by H. J. Huester for Jacksonville.

Detroit Concludes Series on Heat Treatment



Lecturer C. A. Siebert (Left) With Technical Chairman Norman Spooner



W. C. Truckenmiller (Left), Speaker, With Technical Chairman G. Lahr



Technical Chairman Kenneth Packer and Lecturer L. A. Danse (Left)

A highly successful Spring educational lecture series covering the "Heat Treatment of Steels" was recently completed by Detroit Chapter.

Each of the three lectures was received by a highly enthusiastic audience of shop men, technicians, junior engineers and others interested in the field of heat treatment. Some persons traveled from as far as Jackson (65 miles west) and Bay City (100 miles north) to attend the lectures which were presented in the Rackham Memorial Building in Detroit. The average attendance at each meeting was 326. More than 375 people registered for the course and attended at least two lectures.

The series was designed to present heat treatment in a fashion which would give the listener a feeling for

the basic principles involved in heat treating as well as some understanding of the application of these principles to everyday use.

C. A. Siebert and W. C. Truckenmiller of the University of Michigan ably presented the fundamentals involved in heat treatment of steels, and L. A. Danse, recently retired from General Motors Corp., discussed the practical side of heat treatment.

The first lecture by Dr. Siebert covered the iron-carbon equilibrium system, the role of carbon and alloying elements in the hardening reaction and the structures formed on heating and cooling steels. Prof. Truckenmiller stressed the role of carbon and alloying elements in the hardening reaction and the structures formed on heating and cooling steels.

Prof. Truckenmiller stressed the role of carbon in governing the properties of steels and described the use of S-curves, hardenability and the practical applications of hardenability data. In the final lecture, L. A. Danse very adroitly tied the fundamentals to the shop practices with the general theme that metallurgical structure control is important only as long as we can hold the piece together during the heat treatment. Drawing from a vast background of material he showed that practical heat treat operations have to be seriously considered to produce desired metallurgical properties in a given part.

Textbook for the course was the A.S.M. book "Principles of Heat Treatment" by M. A. Grossmann.—Reported by K. F. Packer for Detroit.

Cites Materials Problems In Nuclear Reactors at Meeting of Purdue Chapter

Speaker: Frank G. Foote
Argonne National Laboratory

Frank G. Foote, director of metallurgy division, Argonne National Laboratory, spoke on "Materials Problems in Nuclear Reactors" at a meeting held by Purdue.

The fissioning of uranium-235, uranium-233 and plutonium is associated with the release of an immense amount of energy and excess neutrons. One gram of uranium-235 releases 22,500 kw-hr. of energy which, during the early period of development, was considered waste and a problem to spend.

Present plans to harness the released energy may create a new basic power source. However, in the United States, it must compete with coal, gas turbine and hydroelectric power sources. Power from nuclear reactors will be especially welcomed in areas where the other

sources are not easily available, as in some sections of the United States and nearly all of Europe and Asia.

Since uranium from ores is 99.3% uranium-238, only 0.7% is fissionable as uranium-235. Consequently, if uranium is to be fully utilized it should be made into plutonium which is 100% fissionable. Thorium can be made into fissionable uranium-233.

The rapid development of metallurgical data for the reactor metals since 1939 has resulted in the present status that we now know more about uranium, thorium, beryllium, cerium, zirconium, etc., than we know about pure iron, copper and other common metals.

Because of the undesirable absorption of the free neutrons by structural or cladding materials, the choice of material is limited to those with a low thermal neutron absorption cross section (barn units).

The materials with low absorption cross sections are the most desirable choices. However, they are generally highest in cost, less available and less is known about their properties. The materials with intermediate barn

values are generally used because they are comparatively cheaper and more available. The high-barn materials cannot be used because of their high neutron absorption rates.

Coolants are used to remove the released heat in nuclear reactions. Three classes of coolants have been considered—gas, water and liquid metals. The heat transfer coefficient of water is about 20 times the coefficients of helium and air; liquid sodium and lithium have heat transfer coefficients over twice that of water.

Much information has been gained in the study of liquid metals to overcome such problems as corrosion, induced radioactivity, pumping and circulating of liquid metals, and the disposal of radioactive material.—Reported by J. J. Phillips for Purdue.

has produced and makes available for showing before chapters and educational institutions, moving picture films pertaining to metals.

Describes Copper and Its Alloys



During the Question and Answer Session Following a Discussion of "Copper and Copper-Base Alloys" at a Meeting in Indianapolis, George Shubat, Publicity Chairman, Goes Over a Point With the Speaker, L. E. Gibbs, of Revere Copper and Brass, Inc. (Photograph by Bill Wootan for Indianapolis)

Speaker: L. E. Gibbs

Revere Copper & Brass, Inc.

"New Developments and Applications of Copper and Copper-Base Alloys" was the subject of a talk given by L. E. Gibbs, Revere Copper and Brass, Inc., at a meeting held by the Indianapolis Chapter.

Mr. Gibbs emphasized that copper and its alloys have been in use for many centuries. Its usefulness began in the ancient civilizations of the world and has progressed to the point where it now forms an integral part of our daily life. However, from the standpoint of actual tonnage produced, copper and its alloys cannot be compared to carbon steels, but each is of vital importance to our present-day needs.

The term "new developments in copper and copper-base alloys" is a misleading one, due to the long existence of copper, and it is perhaps more appropriate to state that new developments in the copper industry are in the use and manufacture of copper and its alloys.

We have many types of commercial copper, namely, electrolytic, silver-bearing, oxygen free, phosphor deoxidized and free machining.

If especially high ductility is essential, the copper must be oxygen free. This type of copper is produced by deoxidizing the molten metal with phosphorus or some other element having a high affinity for oxygen. The residual phosphorus reduces the conductivity of the copper by as much as 20%. The free-machining type of copper can readily

be formed with slight additions of tellurium and, by adding a few ounces per heat ton of silver, the annealing temperature of copper can be increased quite economically. Copper is malleable and is hot and cold worked into sheets, plates, tubes and a variety of other shapes. Copper is also the best heat conductor of any of the commercial metals.

Brass alloys containing more than 34% zinc are two phase and may be readily hot worked. Those alloys containing a lesser composition of zinc can be cold worked readily. Mr. Gibbs stated that the grain size must be kept small to offset orange peel effect. He pointed out that the high brasses are subject to season cracking as well as dezincification, but both can be controlled by proper treatments. However, the low brasses are not generally subject to season cracking if the copper content exceeds 80%.

Mr. Gibbs discussed the tin alloys which contain from as little as 1% to as much as 11% tin. The leaded brasses are those alloys containing lead additions to increase their machinability. He pointed out that the lead is insoluble and breaks up the chips in machining. These alloys can be formed somewhat, but a large die radius must be used in the drawing process.

The silicon bronzes are high-strength alloys. They are used quite extensively in the manufacture of bolts, screws, etc. The strength of these alloys increases as the amount of silicon increases up to about 3%.

They can be drawn beautifully and possess good qualities of corrosion resistance.

The most important development in recent years in the copper and copper-base alloys industry are the aluminum bronzes. One alloy contains approximately 90% copper, 8% aluminum and 2% iron. Mr. Gibbs stated that in the annealed condition, tensile strengths of 70,000 psi. have been attained. These alloys are used extensively for nonmagnetic applications.

Another important addition to the copper alloy field is that of the beryllium-copper alloys. They are the strongest in the copper field; however, they are quite expensive for extensive commercial use.

The copper-chromium alloys possess good qualities of conductivity, ranging from 70 to 80%. However, it is impossible to attain high conductivity and high tensile strength at the same time.

Mr. Gibbs concluded with a discussion of the copper-nickel alloys. He stated that nickel additions increase tensile and yield strengths.—Reported by Robert Fesko for Indianapolis.

Montreal Combines Annual Meeting With Ladies Night

The annual meeting of the Montreal Chapter was held in conjunction with Ladies' Night recently. J. U. MacEwan, the outgoing Chapter chairman, and Mrs. MacEwan presided at the dinner, which was attended by 248 members and their ladies.

The following past-chairmen were recognized: K. C. Baker, R. W. Barram, B. Collitt, E. A. DeJean, F. O. Farey, H. T. Hamon, A. H. Lewis, C. K. Lockwood, A. T. Loucks, T. C. McConkey, C. F. Pascoe, G. W. Scott, E. M. Seale and G. M. Young. The following past-chairmen were unable to attend: F. R. Barnsley, C. M. Carmichael, C. E. Herd, S. B. McRobert, G. E. Tait, C. R. Whittemore and E. C. Winsborrow.

Twenty-five year certificates were presented to: Arthur Balfour Co. Canada Ltd., represented by E. H. Horsey; Crane Ltd. represented by C. Laprairie; T. V. Green of Robert Mitchell Co. Ltd.; G. McMillin of Canadian Car & Foundry; Railway & Power Engineering Corp. Ltd., represented by A. T. Loucks; and G. H. Rennie and H. Richardson.

The speaker for the evening was Miss Carol Lane, travel director, Shell Oil Co. of Canada Ltd. who gave a talk on "Traveler Planning".

The Chapter chairman read his report for the year and announced that the membership stood at 464, although 15 members had been transferred to the newly formed Quebec Chapter. Subsequently, the incoming chairman, J. J. Waller, took over his office.—Reported by Rafe Sherwin for the Montreal Chapter.

Discusses Fabrication of Titanium



J. P. Nielsen (Center), Newly Elected Chairman of the New York Chapter, Discusses the "Fabrication and Uses of Titanium and Titanium Alloys", Subject of the Talk Given by T. W. Lippert (Left), Manager of Sales and Technical Service, Titanium Metals Corp. of America. Mr. Lippert was introduced by I. Kramer (right), vice-president of the Mercast Corp.

Speaker: T. W. Lippert
Titanium Metals Corp. of America

T. W. Lippert, manager of sales and technical service, Titanium Metals Corp. of America, presented a talk entitled the "Fabrication and Uses of Titanium and Titanium Alloys" at a meeting held recently by the New York Chapter.

Mr. Lippert was introduced by I. Kramer, technical chairman, who indicated that present production of titanium sponge is approximately 8000 tons per year.

The speaker, Mr. Lippert, then proceeded to illustrate the rapid growth of the industry over a commercially productive period of only five years, with its ensuing high points of accomplishments and difficulties.

Because of its very favorable strength-weight ratio, limited production and relatively high cost, the aircraft industry is the main consumer of titanium. Its continued usefulness is evidenced by the fact that a newly designed jet engine incorporates at least 80% titanium as structural material. Titanium-base alloys are now used up to 900° F. for long time service, with 1200° F. appearing to be a feasible service temperature sometime in the future.

The bulk of alloy production in bar and billet is now in the aluminum-vanadium-titanium series.

A high point of difficulty, which was licked by the end of 1954, was understanding the effect of hydrogen in titanium on the ability to withstand sustained stress. After determining the maximum amounts of hydrogen and methods of removal, large lots of titanium mill products were reclaimed by vacuum annealing, and new production by consumable-arc vacuum melting effectively held hydrogen to specification limits.

It was further indicated by Mr. Lippert that the present knowledge of double melting procedures for homogeneity and vacuum annealing for hydrogen removal is ahead of

public releases which might indicate technological difficulties interfering with production.

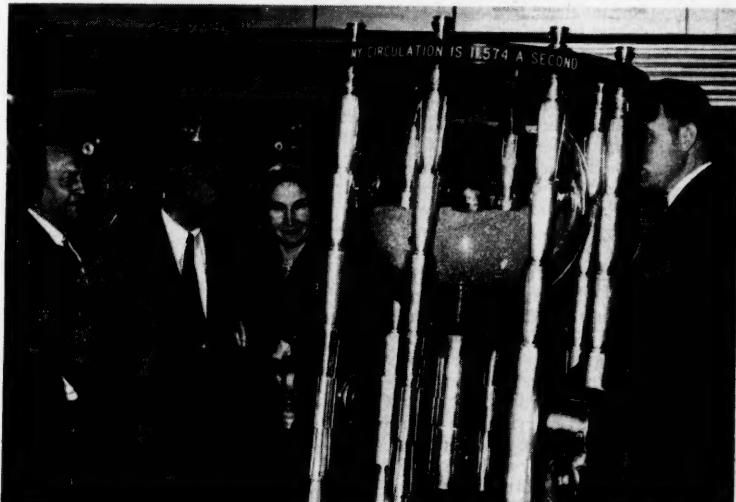
Commercially pure titanium scrap is being reclaimed. Often as much as 20% of each production charge consists of scrap.

Mr. Lippert brought out the fact that the machining of titanium is greatly facilitated by maintaining efficient tool tip cooling.

March 1955 was a record month for titanium production, with shipments double that of a year ago. The future independence from the aircraft industry depends on product development, expanded production and further decreased cost with the Kroll process indicated as the best method of titanium production.

Mr. Lippert's talk was preceded by W. A. Stadler turning over the chairmanship to J. P. Nielsen and the presentation of two A.S.M. certificate awards to metal students in the New York Chapter Area. This being Student's Night, approximately 25% of the group attending the meeting were interested students—Reported by D. A. Cardwell for New York Chapter.

Indianapolis Enjoys Powerama Exhibit



A Portion of the Powerama Display of the Allison Division of General Motors Corp., Which Guests of the Indianapolis Chapter Enjoyed During Their Ladies Night Meeting. (Photograph by Noble York for Indianapolis)

The Allison Division, General Motors Corp., was host to the Indianapolis Chapter's Ladies Night meeting, held at their colorful Powerama display. About 225 ladies, members and guests enjoyed the dinner presented by their host, and the tour through the Powerama exhibits.

In a room where the past rubs elbows with the future, the layman can obtain, in capsule form, a vivid description of what Allison is and what it does. This permanent exhibit of Allison products and product development serves many purposes, but primarily it is a place where employees, friends and students can become better acquainted with the

work and products at Allison.

The Powerama display tells the story of man's conquest of power, the story of modern air power, beginning with the first reciprocating engine and extending through today's big turbo-jet and turbo-prop engines, and a story of more efficient and economical manufacturing methods. It is the story of American industry, where skill in design and perfection in manufacture are necessary and expected. The exhibit is a tribute to men of science and presents an insight into what can be expected from scientific endeavor in the future.—Reported by Robert Fesko for Indianapolis.

Tri-City Features forgings and Metallographs



Ray Blom (Center), Ladish Co., Who Spoke on "Forgings" at Tri-City, Is Shown With Chairman Ralph W. Rogers and Immediate Past Chairman Victor H. Vieths, Jr.

Speaker: Ray Blom
Ladish Co.

Ray Blom, assistant chief metallurgist, Ladish Co., addressed the Tri-City Chapter on "Forgings — Their Place in Design and Manufacture" recently.

Mr. Blom stated that forgings have long been recognized as the ultimate in engineering materials because of the toughness imparted by properly designed grain flow. Cast ingots usually contain segregation, entrapped gas, shrinkage cavities and non-metallics, due chiefly to the relatively slow solidification rate. Hot working the ingot, whether by forging or rolling, not only produces a desired geometry but also alters structure, breaks up segregates and actually welds cavities or voids. The nonmetallics are broken up and distorted and the inherent coarse crystalline structure is reduced to one that is finer. Direction of metal flow and amount of reduction affect distribution and shape of the nonmetallics, imparting a definite influence on the grain flow associated with wrought steel.

The speaker discussed the results of investigations that have been made to study the effects of reduction and forging methods upon the mechanical properties of steel. Tests have shown that neither the amount of reduction nor the method of forging have any effect on the strength properties of a given hardness level with regard to the direction of grain flow. The tests, however, do show that the extremely high pressures used in closed-die forging develop higher transverse ductility and notched bar toughness in steel treated to varying ranges of strength. The fact that pressure alone in closed-die forgings effects an improvement in transverse ductility has been demonstrated by tests in which the amount of plastic

deformation was negligible.

Mr. Blom discussed the various types of forging machines in use and recent developments in machines for forging. Probably the most common forging machine is the steam hammer. In this machine the forging is made between a stationary lower die and the freely falling weight of the ram, rod and piston, accelerated by the pressure of the expanding steam in the cylinder. Board drop hammers are used to a large extent in the production of smaller drop forgings. Here, energy is developed by a freely falling weight from a constant height for successive strokes. Mechanical and hydraulic presses are used widely for production of contour or closed-die forgings of relatively small size. Upsetting machines also are used to produce certain

shapes made with presses and hammers. The design of the upsetting machine and its manner of operation make it especially valuable for forging only a portion of a bar. It also affords an economical method of gathering stock for subsequent final forging operation.

A recent development has been the large counterblow hammers. In this hammer, the large inertia mass required in the form of an anvil block is avoided by mounting the lower die in a movable ram which reciprocates counter to the upper ram and die. The two rams meet at the center of their combined travel with a complete conservation of momentum, in contrast to transmitting the force of the blow through the forging to the stationary anvil block and foundation. — Reported by P. N. Walseth for Tri-City.



Members of the Tri-City Chapter Are Shown as They Look Over the A.S.M. Traveling Metallographic Exhibit Which Was on Display During a Recent Meeting

Roberts Guest of Washington Chapter



During the National Officers Night Meeting Held by the Washington Chapter, National President George A. Roberts Talked on "New Developments in the Field of Toolsteels". Present at the meeting were, from left: W. A. Pennington, national treasurer; Dr. Roberts; M. R. Meyerson, incoming Chapter chairman; R. E. Wiley, chairman; and O. T. Marzke, who was presented a 25-year membership certificate. (Reported by H. E. Stauss)

Toledo Members Hear Problems Relating to Engineering Profession

Speakers: Delos M. Palmer and Maurice H. Bigelow

Members of the Toledo Chapter heard Delos M. Palmer, Delos M. Palmer and Associates, Consulting Engineers, and Maurice H. Bigelow, superintendent, Plaskon Laboratories, Barrett Division, Allied Chemical and Dye Corp., speak during a recent meeting.

Mr. Palmer presented the "Problems of an Engineer". He pointed out that there is something wrong in a profession when college graduates of potential but little immediate value, are hired at \$400 per month, and turned over for training to men of 20 years experience who are probably being paid only \$600 per month.

Mr. Palmer believes the cure for this situation lies in recognition, and that this recognition of the engineering profession must come from the individual. He recommends that the engineer become more vocal and

praise his profession to his employer, to the public and his family. Greater participation in outside activities brings the engineer into contact with the public and gives him an opportunity to promote his profession.

Dr. Bigelow, who took over where Mr. Palmer left off, initiated his talk on "Factors Promoting the Growth of Plastics" with the question, "Are engineers people?" Engineers, he stated, seem to feel that they are different and thus present unnecessary problems to management. He pointed out that engineers must learn to communicate with others, both inside their organization and by participation in civic affairs.

Dr. Bigelow undertook to adjust his talk to serve as a demonstration of how to present a technical subject in an entertaining manner. He started with a dry graphical presentation of the growth of the plastics industry, and used this as an example of how not to present a subject. He then ran some 100 slides which were interesting and which gave in an entertaining manner the many fields of application or mis-application of plastics.—Reported by H. K. Hybarger for Toledo.

Boston Welcomes New 25-Year Members



Boston Chapter Welcomed New Members of the A.S.M. 25-Year Club During a Recent Meeting. Chairman Morris Cohen (left) is shown presenting certificates to J. B. Savits, P. R. Kosting, Edwin Hope and Leo Madard

NE Pennsylvania Entertains Ladies



The Northeast Pennsylvania Chapter Observed Its First Annual Ladies Night Recently. J. V. M. Ross, ophthalmologist from Berwick, Pa., Presented a talk entitled "Life and Poetry". At the speaker's table are, from left: Mrs. and Mr. L. P. Clare, and Mr. and Mrs. J. J. Penkoske

Schedules Graduate Course In Nuclear Engineering

Nuclear Engineering, a two-semester M.S. degree program, is offered by the Division of Mechanical Engineering, University of California, in cooperation with the university's Radiation Laboratory. Particular attention will be focussed on analysis, design, performance prediction and cost of nuclear power systems. The program will consist of the following courses:

Fall Semester 1955

Nuclear Reactor Physics

Fluid Mechanics, Heat and Mass Transfer

Power Cycles and Systems

Applied Mathematics

Spring Semester 1956

Reactor Dynamics and Automatic Control

Engineering Materials for Reactor Systems

Process Heat and Mass Transfer

Nuclear Reactor and Power Plant Systems Design

The staff will include eminent physicists and nuclear engineers. Weekly seminars on selected topics in nuclear energy will be an intrinsic part of the program. These will be held at the University Radiation Laboratory facilities in Berkeley and Livermore. The reactor at Livermore will be made available for inspection and use by students.

Selected portions of the program may be used by those qualified for a program leading to a Ph.D. degree. Completion of a curriculum in engineering of physics constitutes the normal prerequisite for this program. Enrollment is limited, so application should be made promptly.

Application for admission should be made to the Graduate Division, Administration Bldg., University of California, Berkeley, Calif.

OBITUARIES

ALLEN F. BECK, 72, president and general manager of the Clark Grave Vault Co., died at his desk in May. During the war, Mr. Beck's company produced 250,000 tons of war material, including armor plate, airplane fuel tanks and aircraft landing mats, as well as artillery shells and rocket bombs. He was a member of the Columbus Chapter.

GUSTAF A. LILLIEQVIST, research director for American Steel Foundries, died suddenly of a heart attack late in May. Mr. Lillieqvist, who was 61, was known internationally for his contributions to the field of metallurgy. He has been active in the metallurgy of cast steel and has devised numerous alloys and deoxidation practices. Mr. Lillieqvist, who was a member of the Calumet Chapter, was born in London, England, and came to this country in 1924.

Surface Treatment Theme of Series



T. E. Olson, Speaker at the First of the Educational Series Sponsored by the Indianapolis Chapter, Receives a Token of Appreciation From the Educational Committee of the Chapter. Shown, from left, are: Bob Norton, Mr. Olson, and Bill Read, chairman of the educational committee

T. E. Olson, Ohio Crankshaft Co., V. B. Bullens, Cincinnati Milling Machine Co., O. E. Cullen, Surface Combustion Corp., and D. R. Edgerton, Lindberg Engineering Co., were the speakers for the Indianapolis Chapter's educational course on the "Surface Treatment of Steels".

Mr. Olson discussed the "Induction Hardening Process". Induction heating equipment consists of an inductor, quenching auxiliaries, transformers and capacitors, automatic timing controls and a high-frequency generator. The piece to be treated is enclosed in a copper inductor, shaped to fit the part, and a high-frequency current of perhaps 2000 cycles or more is passed through the block. Induced eddy currents heat the surface to be hardened above the upper transformation temperature in 1 to 5 sec. The quenching medium, under pressures, is immediately sprayed onto the hot surface through holes in the inductor block, or the part is indexed into a quenching medium. By induction heating steels can be preferentially hardened to a given depth and hardness. Today this selective method of heating is used to treat a variety of parts and helps solve many manufacturing problems economically and efficiently.

Mr. Bullens discussed "Flame Hardening". This method can be used to heat any spot on the surface of a finished steel article to above the A_3 transformation temperature. Heating is done with acetylene, butane, propane, natural or manufactured gas. Hardening temperatures can be attained in a relatively short time, at rates up to 500° F. per sec. on light sections; therefore, the time at heat must be controlled accurately. After treatment, the part is immediately quenched and then tempered to relieve quenching stresses. The process is economical, and under

controlled conditions, a flame hardened part does not pit or scale, it hardens only at the surface and to a depth of not more than $\frac{1}{4}$ in., chemical composition is not affected and distortion is minimized. Conversely, parts having small pores or long holes, inaccessible areas, irregular inside diameters, dead-end holes, angular holes, abrupt sections, and large areas, are difficult to process. Flame hardening apparatus has been developed in many variations for an ever-widening range of applications.

Mr. Cullen discussed the "Carbo-Nitriding Process". This method case hardens a ferrous alloy by heating it in a gaseous atmosphere, wherein carbon and nitrogen are added simultaneously, and then cooling at a rate to obtain the desired properties. The process has been in use for approximately 20 years; it has also been termed dry cyaniding, gas cyaniding or ammonia carburizing, but has no connection with nitriding. Mr. Cullen stressed that there is no magic formula for putting on a case by using nitrogen. The temperature ranges for carbo-nitriding are from 1300 to 1650° F., usually 1475 to 1600° F. Carbo-nitriding retards the transformation rate and the steel hardens more readily with lower quenching rates, so that oil may frequently be used in place of water. Also, carbo-nitriding minimizes distortion and increases wear resistance. A wide variety of parts are processed effectively by this method; however, Mr. Cullen cautioned that it is no panacea, inasmuch as proper tray loading, atmosphere control of gas analysis and proper circulation must be practiced just as in carburizing. Suitable furnace design was also stressed.

Mr. Edgerton, who spoke on "Carburizing", stated that this is one of

the oldest processes for hardening steel. Three general methods are in use, pack carburizing, gas carburizing and liquid carburizing. Pack carburizing is the cheapest, but it is slowly being replaced by the other two methods because the case depth can be more accurately controlled. The temperature ranges usually employed are from 1650 to 1700° F. Steels of higher carbon content are usually carburized at 1550 to 1600° F. for better control of case depth.

The grain growth abnormality (detected by the McQuaid-Ehn test) of a steel at the carburizing temperature has a great effect on the mechanical properties. The carbon potential in gas carburizing is controlled by the dew point, which must be accurately maintained to realize maximum carburizing efficiency.—Reported by Robert J. Fesko for Indianapolis.

Describes Gem Polishing At Ladies Night Meeting

Speaker: William E. Scheele

Cleveland Museum of Natural History

William E. Scheele, director of the Cleveland Museum of Natural History, talked on "Gem Polishing as a Hobby" at the Ladies Night meeting of the Cleveland Chapter.

As director of the Cleveland Museum of Natural History, Mr. Scheele is well qualified to talk on gems. The museum contains the Wade collection, which is reported to be the fourth largest in the country. Gem polishing is also his hobby.

As an introduction to gem polishing, pictures of famous jeweled daggers were shown and an interesting history of each was given. Each of these daggers had many colored and semiprecious stones embedded in their handles to make a beautiful and expensive-looking piece. The workmanship in gem polishing and gem setting of the pieces adds much to their value.

A rough stone was shown to the audience and the stages of cutting and polishing illustrated by the speaker. In the final stages of gem polishing, lap wheels identical to metallographic wheels are used to polish square gems. When working with hard stones, care must be taken to avoid overheating, which can result in the stone fracturing. In the soft stones, uniform pressure becomes important to prevent gouging. Cutting stones according to facets to get the best light reflections was described.

Mr. Scheele stated that a polishing laboratory is inexpensive and is the only capital outlay, with the exception of additional stones, involved in gem cutting as a hobby. The laboratory requires a cutting wheel, alcohol, heating lamp and two or three polishing wheels for the rough to fine abrasives used to polish gems.—Reported by James J. Skarda for Cleveland.

Explains Methods for Surface Protection of Metals at Columbus

Speaker: Charles L. Faust
Battelle Memorial Institute

Charles L. Faust, chief of the electrochemical engineering division, Battelle Memorial Institute, presented a talk on "Surface Protection of Metals" in Columbus.

Dr. Faust emphasized the effect of surface condition prior to coating on the quality of the finished product. The surface condition is as important as the choice of coating material. Two steel surfaces prepared by different methods were shown. To the naked eye, the mechanically prepared surface appeared to be the same as the electropolished surface. However, examination at high magnification revealed that the mechanically polished surface was severely worked, or "plowed", while the electropolished surface was unmarred.

Properties of a metal surface can be shown by plating, because properties of plated metals vary widely with the surface condition. For example, a surface-distorted steel after plating with nickel had a tensile strength of 35,000 psi., as compared with 90,000 psi. for a nickel-plated steel having an undamaged surface. Another example mentioned was the improved workability resulting from electropolishing instead of mechanical finishing (by grinding or milling) which resulted in the same amount of reduction in four cold-rolling passes instead of six.

Cross-sectional metallographic specimens are useful for determining the depth of distorted metal and for the detection of any nonmetallic particles which may have been embedded from mechanical finishing operations. Heat treatment does not completely remove the distorted surface layer. Nonmetallic particles usually have quite harmful effects on the properties of the subsequently plated product.

Dr. Faust used the term "surface metallurgy" in reference to work on obtaining damage-free metal surfaces.—Reported by E. M. Stein for Columbus Chapter.

Explains Some Anomalies In Corrosion at Fort Wayne

Speaker: Thomas P. May
International Nickel Co.

Members of the Fort Wayne Chapter heard a talk by Thomas P. May, development and research division, International Nickel Co., on "Some Apparent Anomalies in Corrosion".

When apparent anomalies in corrosion appear, investigations always reveal some governing factor which operated in an orderly way in accordance with natural laws. Thus

the observed instances are not really anomalous.

Dr. May's first example had to do with galvanic corrosion. By making open circuit potential measurements in flowing sea water, it is possible to arrange metals in a galvanic series, and from this, as an example, it might be expected that steel coupled galvanically with stainless steel would show greater corrosion than if it were coupled with copper. The opposite is found to be true, however, because of their cathodic polarization characteristics. When testing in quiet sea water, all the cathodes polarize about the same, so that the above effect is noticed principally in turbulent sea water.

Another of Dr. May's examples had to do with the peculiar distribution of corrosion of steel partially immersed in sea water. It is common belief that corrosion will be most severe in the tidal region, be-

cause here the steel is periodically wet with well aerated salt water. Actually, it reaches a minimum in this region, and the greatest corrosion occurs a short distance below the low-tide level because of a large-scale differential aeration cell.

One might expect the corrosion of Monel in sulfuric acid to increase with rising temperature, but the opposite is true because the solubility of air in the sulfuric acid decreases as the temperature increases, and Monel performs best under reducing conditions.

Dr. May presented several more examples and, in conclusion, stated that there is probably a rational explanation for anything that happens by way of corrosion, and that corrosion is not the haphazard sort of thing that some of its manifestations might lead us to believe.—Reported by Lee Van Fossen for Fort Wayne Chapter.

Heat Treat Atmospheres Topic at Texas



O. E. Cullen, Surface Combustion Corp., Spoke on "Various Heat Treating Atmospheres" at a Meeting of the Texas Chapter. Shown are, from left: Marvin Linn, technical chairman; Mr. Cullen; A. R. Oakley, Jr., chairman; and Donald E. Wilson, vice-chairman. (Photo by L. V. Dolan)

Speaker: O. E. Cullen
Surface Combustion Corp.

O. E. Cullen, chief metallurgist for Surface Combustion Corp., spoke before the Texas Chapter on "Various Heat Treating Atmospheres" at a meeting held recently.

Industry has recognized the need for controlled atmospheres in metal treating. In recent years great strides have been made in the development and use of equipment for doing this work.

Mr. Cullen showed many interesting slides of gas atmosphere producing equipment, furnaces, compositions of atmospheres for the various types of heat treating, and structures of heat treated metals.

When heat treating ferrous metals, controlled atmospheres may be required to be oxidizing, reducing or carburizing. Gases which are oxidizing are oxygen, water vapor or carbon dioxide. Reducing gases are hydrogen, methane, natural gas or car-

bon monoxide. Methane, natural gas, propane and carbon monoxide are carburizing. Controlled atmospheres usually contain predetermined amounts of most of these gases.

Particular emphasis was placed on the successful use of carbon controlled atmospheres for carburizing, carbon restoration and homogeneous carburizing.

Many intricately formed parts are made from soft, low carbon steel and later homogeneously carburized to the desired carbon content. This process has enabled industry to substitute these low carbon steels for higher carbon material with resulting savings in cost of raw material, better forming characteristics and lower scrap losses.

The practical application of dew point controlling equipment to control of carbon in batch and continuous furnace operation was discussed at some length.—Reported by Joe B. Marx for Texas.

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared by the Technical Information Division
of Battelle Memorial Institute, Columbus, Ohio

A

General Metallurgical

69-A. Foundry Noise and Its Control. Herbert T. Walworth. *American Foundryman*, v. 27, May 1955, p. 104-109.

Technical factors of industrial noise exposures and some practical approaches to its control. Graphs, diagrams. 6 ref. (A5)

70-A. Some Factors Influencing the Production of Manganese. H. W. Hosking. *Australasian Engineer*, 1955, Mar., p. 70-75.

Successful operation of the two-stage process depends on control of fusion points, viscosities and thermal and electrical conductivities of the slags involved. Diagrams, graphs. (A8, Mn)

71-A. A Dictionary of Metallurgy. A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging*, v. 22, May 1955, p. 203-210.

From "platinum alloys" to "preferential deformation". Tables, micrographs, diagrams, photographs. (To be continued.) (A10)

72-A. Manganese From Steel-Plant Slags by a Lime-Clinkering and Carbonate-Leaching Process. I. Laboratory Development. R. August Heindl, J. A. Ruppert, M. L. Skow and J. E. Conley. U. S. Bureau of Mines, Report of Investigations 5124, Apr. 1955, 98 p.

Laboratory tests justify feasibility of recovering a high-grade manganese oxide and indicate that the process should be expanded to pilot-plant scale. Graphs, tables, flow sheets, diagrams, photograph. 5 ref. (A8, Mn)

73-A. Metallurgical Research in the Electrical Industry. Ivor Jenkins. *Birmingham Metallurgical Society, Journal*, v. 35, Mar. 1955, p. 151-168.

Role of research in the industry. Photographs. (A9, T1)

74-A. (Book.) Some Aspects of the Canadian Iron and Steel Industry With Particular Reference to British Columbia. G. P. Contractor. 175 p. 1954. British Columbia. Research Council, Technical Bulletin No. 21, University of British Columbia, Vancouver 8, Canada. \$4.00.

A study of steel production facilities such as coal, iron ore and power resources in the province, including a description of the Tysland-Hole electric furnace and the economics of its operation. (A4, D general, ST)

B

Raw Materials and Ore Preparation

91-B. Grading Minnesota Iron Ores for the Blast Furnace. Myron W. Griswold. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 6 p.

Sampling and analysis of iron ore cargoes. Tables, diagrams. (B11, Fe)

92-B. The Making of Self-Fluxing Sinter and Its Use in the Blast Furnace. Christer Danielsson. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 16 p.

Sinter production; effect of ore preparation on blast furnace performance. Graphs, tables, photographs. 20 ref. (B16, D2, Fe)

93-B. Permeability of Sinter-Plant Feed. M. O. Holowaty and John F. Elliott. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 13 p.

Factors that influence the permeability of the raw sinter feed. Tables, photographs, diagram, graphs. 5 ref. (B16, Fe)

94-B. Production and Properties of Experimental Pellet-Sinter. F. M. Hamilton and H. F. Ameen. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 8 p.

Laboratory studies of a hybrid agglomerate, termed "pellet-sinter", which was prepared by a procedure utilizing a combination of the pelletizing and sintering processes. Tables, photographs, graphs, micrographs. (B16, Fe)

95-B. Production and Use of Iron Coke. Charles C. Russell, P. Whitstone and R. P. Liggett. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 27 p.

The coding symbols at the end of the abstracts refer to the ASM-SLA Metallurgical Literature Classification. For details write to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Upgrading of fine sizes of iron ore and blast furnace flue dust by blending the fine material with coal and coking the mixture in coke ovens. Tables, graphs, micrograph, photographs. 17 ref. (B22, D1, Fe)

96-B. Sintering Practice at Ford Motor Company. Robert L. Cleveland. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 9 p.

Equipment and operating procedures. Photographs, flowsheet, tables. (B16, Fe)

97-B. Study of the Productivity of Conventional Dwight-Lloyd Sintering Machine. M. O. Holowaty, H. A. Goldfein and C. B. Sheets. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 34 p.

Factors affecting rate of sinter production. Graphs, photographs, tables, diagrams, chart. 22 ref. (B16, Fe)

98-B. Effect of Beryllium Alloying Additions. (Digest of "Beryllium as an Alloying Addition", by L. David. *Metallurgia*, v. 50, Nov. 1954, p. 236-238.) *Metal Progress*, v. 67, May 1955, p. 152, 154, 156.

Previously abstracted from original. See item 28-B, 1955. (B22, Q general, Be, Mg, Al, Ni, Cu)

99-B. Studies on Chlorination of Ilmenite. R. Manocha. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 95-104.

The selective chlorination of the iron of ilmenite with the object of reducing the iron content of the mineral, thus beneficiating it in titanite. Tables. 14 ref. (B14, Ti)

100-B. Sintering Practice at Rouge Plant Utilizes Low-Grade Hematite. Robert L. Cleveland. *Journal of Metals*, v. 7, May 1955, p. 616-618.

Operation at the Ford Motor Co. plant for production, conveyance, storage and testing of sinter for blast furnaces. Photographs, table, diagram. (B16, D1, Fe)

101-B. Grinding and Classification at Humboldt. L. J. Erck. *Mining Congress Journal*, v. 41, May 1955, p. 32-35.

Operating mill exceeds capacity estimated on basis of pilot plant experience. Photographs, diagram. (B13, Fe)

102-B. Handling Difficult Flotation Froths. W. H. Reck. *Mining Engineering*, v. 7, May 1955, p. 471-472.

Pumps and other elevating equipment. Diagrams. (B14)

103-B. (German.) Characteristic Magnitudes for Evaluating the Properties of Suspensions in Ore-Beneficiation Plants. Friedrich Wilhelm Mayer. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 8, no. 4, Apr. 1955, p. 138-146.

Relations between solid content

- and density of slurries. Tables, graphs, diagrams. 8 ref. (B14)
- 104-B. (German.) The Stripa Specific Gravity Process. Jonas Svensson. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 8, no. 4, Apr. 1955, p. 147-152.
- Sink-float separation method utilizes a heavy-medium liquid flowing in a shaking trough. (B14)
- 105-B. (German.) Contribution to the Treatment of Cassiterite. Werner Gründer. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 8, no. 4, Apr. 1955, p. 152-157.
- Review of methods of concentrating tin ores. Tables. 11 ref. (B14, Sn)
- 106-B. (German.) Principles and Possible Applications of the Elutriation Process in Ore Beneficiation. Franz Kirnbauer. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 8, no. 4, Apr. 1955, p. 157-161.
- Comparison of horizontal and vertical washing methods. Diagrams, photographs, tables. 13 ref. (B14)
- 107-B. (German.) The Classifying Effect in the Rosin-Rammler-Bennett Net. Helmut Trawinski. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 8, no. 4, Apr. 1955, p. 162-170.
- Ore grinding and classifying methods. Graphs. 14 ref. (B13)
- 108-B. (Hungarian.) Thermodynamic Investigation of the Reactions Taking Place During the Roasting of Pyrite and Sphalerite. Zoltan Horvath. *Kohuszati Lapok*, v. 10, no. 4, Apr. 1955, p. 163-176.
- Investigation of reaction kinetics; variation of the thermodynamic normal potential of the process with the temperature; equilibrium composition of the gas and its changes. Graphs. 6 ref. (B15)
- 109-B. (Russian.) Results and Prospects of the Investigation of the Interaction of Reagents With Minerals in Flotation. I. N. Plaksin. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1955, no. 1, Jan., p. 109-134.
- Determination of xanthogenates by radioactive isotopes; absorption data; time of adherence of particles to air bubble. Table, graphs. 33 ref. (B14, Pb)
- 110-B. Treatment of Cuban Nickel-Cobalt Ores. *Mining Journal*, v. 244, May 13, 1955, p. 530-532.
- High economy recovery; treatment of nickeliferous ores; metallurgical investigations. (B14, Co, Ni)
- 111-B. (Danish.) The Grinding Process Shown by the Principle of Similarity. A. H. M. Andreasen. *IVA Tidskrift för Teknisk-Vetenskaplig Forskning*, v. 26, no. 3, 1955, p. 86-93.
- Theory of similarity applied to the different mill types furnishes a comprehensive insight into their working conditions and efficiency. Graphs, diagram, table. 5 ref. (B13)
- 112-B. (Book—French.) The Enrichment of Iron Ores. L. Coche. 158 p. Centre D'Etudes Supérieures de la Sidérurgie, 17, Avenue Serpenoise, Metz, France.
- Survey of physical, chemical, and metallurgical processes in France and abroad. (B general, Fe)
- 104-C. (English.) Design and Operation of Reactors for Titanium Production. L. Gillemot. *Acta Technica Academiae Scientiarum Hungaricae*, v. 19, nos. 1-2, 1955, p. 221-245.
- Construction and operating experience with large reactor for use in the Kroll method of titanium production. Diagrams, photographs, graphs, tables. 15 ref. (C26, Ti)
- 81-C. Chemical Aspects of the Atomic Industry. E. Glueckauf. *Endeavour*, v. 14, Apr. 1955, p. 83-89.
- Production of plutonium; chemical separation during recycling; disposal of fission products; utilization of fission products in the future. Tables, graphs, flow diagrams, photographs. 5 ref. (C general, T general, Pu, U)
- 82-C. Preparation of Titanium by Kroll's Process. R. Manocha, P. P. Bhatnagar and T. Banerjee. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 81-94.
- Results of investigation carried out for determining the optimum condition for the production of titanium. Diagrams, tables. 8 ref. (C26, Ti)
- 83-C. Melting Furnaces for Non-Ferrous Metals. II. W. A. Darrah. *Industrial Heating*, v. 22, Apr. 1955, p. 726 + 4 pages.
- Types of furnaces described. Photographs. (To be continued) (C21)
- 84-C. Experimental Production of Al-Si Alloys in a Three-Phase Furnace. Lloyd H. Banning and William F. Herget. *Journal of Metals*, v. 7, American Institute of Mining and Metallurgical Engineers, *Transactions*, v. 203, May 1955, p. 630-633.
- Advantages of a smelting technique utilizing hogged wood waste as part of the reductant and for temperature control. Tables. 13 ref. (C21, Al, Si)
- 85-C. Hydrometallurgy of Copper-Zinc Concentrates. Hidesaburo Kurushima and Suketoshi Tsunoda. *Journal of Metals*, v. 7, American Institute of Mining and Metallurgical Engineers, *Transactions*, v. 203, May 1955, p. 634-638.
- Recovery of both the copper and zinc by roasting in a fluidized bed. Tables, flowsheet. (C21, Zn, Cu)
- 86-C. British Furnace Developments. D. Llewellyn. *Metal Industry*, v. 86, Apr. 29, 1955, p. 339-344.
- Advantages and disadvantages of furnaces for melting and heat treating. Table, photographs. (C general, D general, T general)
- 87-C. (German.) High-Vacuum Furnaces. Werner Scheibe. *Zeitschrift für Metallkunde*, v. 46, no. 4, Apr. 1955, p. 242-253.
- Structural characteristics, fields of application. Photographs, diagrams, table. 13 ref. (C25, D8)
- 88-C. Indirect Arc Furnace Reduces Costs With Rapid, Efficient Melting. O. P. Toneguzzo. *Canadian Metals*, v. 18, May 1955, p. 29, 32.
- Equipment and operating details of furnace used for nonferrous metals. (C21)
- 89-C. The Oxygen Flash Smelting Process of the International Nickel Company. *Canadian Mining and Metallurgical Bulletin*, v. 48, no. 517, May 1955, p. 292-300; *Canadian Institute of Mining and Metallurgy, Transactions*, v. 58, 1955, p. 158-166.
- A process developed for autogenous smelting of fine sulphides. Diagrams, tables, graphs, photographs. 17 ref. (C21)
- 90-C. The German Lead Smelters. C. W. Jensen. *Mining Magazine*, v. 92, May 1955, p. 265-277.
- Review of equipment, practice and processes. Tables. (C21, Pb)
- 91-C. (German.) Technical Preparation of Substances in Pure Condition. Demonstrated on Semifinished Germanium. F. W. Dehmelt. *Chemie-Ingenieur-Technik*, v. 27, no. 5, May 1955, p. 275-278.
- Zone melting process for the preparation of germanium in pure condition. Table, diagrams, graphs. 6 ref. (C5, Ge)
- 92-C. (Swedish.) Swedish Shale as Raw Material for Uranium. Erik Svenke. *IVA Tidskrift för Teknisk-Vetenskaplig Forskning*, v. 26, no. 3, 1955, p. 75-80.
- Amount of uranium that can be extracted from Swedish shale and principal flow sheet for uranium production from shale. Diagram, tables, photograph. 1 ref. (C general, U)

D

Ferrous Reduction and Refining

196-D. Applications in the United States for Some European Improvements in the Blast Furnace Field. Daniel Petit. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 3 p.

Suggestions for using recent European improvements in coking equipment and blast furnace stoves. Table. (D1)

197-D. Blast Furnace Stove Cleaning. L. R. Robinson. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 4 p.

Cleaning methods and costs; effects on production economics. (D1, Fe)

198-D. One Hundred Per Cent Sinter Burden at Gary Works. R. W. Sundquist. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 11 p.

Production runs proved that a blast furnace can be operated successfully and efficiently on a burden of 100% sinter. Tables, diagram, graphs. 11 ref. (D1, Fe)

199-D. A Report on Solid Movement in Blast Furnace Models. J. B. Wagstaff. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 23 p.

Movement of the stock column in the blast furnace investigated by use of two models, a thin slice model and a semicircular one. Diagrams, photographs, graphs. 11 ref. (D1, Fe)

200-D. Statistical Evaluation of Open Hearth Production Factors. E. J. Sobey and R. E. Minto. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 5 p.

Efficacy of using hot metal, effects of production factors on melt quality. Graphs. (D2, ST)

201-D. Use of Open Hearth Slag in Blast Furnaces, and Effect on Open Hearth Practices. E. B. Speer. *American Institute of Mining and Metallurgical Engineers, Electric Furnace Steel Conference, Preprint*, 1955, 5 p.

Development of practices that permit use of large quantities of slag in a blast furnace; subsequent use of the hot metal in an openhearth furnace. Table, graphs. (D1, D2)

202-D. (Russian.) Behavior of Sulfur in Gases During Melting in a Blast Furnace. I. S. Kulikov and L. M.

C

Nonferrous Extraction and Refining

80-C. (English.) Design and Operation of Reactors for Titanium Production. L. Gillemot. *Acta Technica*

- Tsylev. *Izvestia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1954, no. 12, Dec., p. 102-119.
- Survey of studies attempting thermodynamic analysis of this problem. Sulfur in various reactions, collation of equations of change of free energies, temperature relation. Tables, graphs. 14 ref. (D1, ST)
- 203-D. Blast Furnace Bears Under Indian Operating Conditions.** H. Schrader and T. V. Cherian. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 27-43 + 1 plate; disc., p. 43.
- Results of thorough investigation of a bear removed from a blast furnace of 900 tons daily capacity and dismantled after a campaign of 9½ yr. Diagrams, tables, photographs, graphs. 18 ref. (D1)
- 204-D. Production of Low-Carbon Ferro-Chrome.** A. B. Chatterjee, G. P. Contractor and B. R. Nijhawan. *Indian Institute of Metals Transactions*, v. 7, 1953, p. 45-57; disc., p. 57-60.
- Attempts to produce, in one operation, a ferrochrome using ferrosilicon made in India. Tables, graphs. 22 ref. (D8, Cr, Fe)
- 205-D. Desilicization of Blast Furnace Hot Metal.** J. Pearce. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 251-258.
- Principal advantages of keeping low and constant silicon contents in the hot metal supply for basic open-hearth furnaces and the various processes of desilicization. Diagram. 17 ref. (D1)
- 206-D. Continuous Casting of Steel.** J. S. Morton. *Iron & Steel*, v. 28, May 1955, p. 167-171.
- Technical problems; plant procedures. Diagrams, table, graph. 4 ref. (D9, ST)
- 207-D. Refractories in the Iron and Steel Industry. IV. Other Applications.** Helen Towers. *Iron & Steel*, v. 28, May 1955, p. 173-176.
- Critical review of refractories for blast furnace stoves and ladles and for casting pits. 60 ref. (D1)
- 208-D. Gas-Turbo-Driven Blower.** C. E. Sayer. *Iron & Steel*, v. 28, May 1955, p. 225-233.
- An analysis and evaluation of two European gas-turbine plants used in blast furnace service. Graphs, diagrams. (D1)
- 209-D. Furnace Bunching.** R. Solt. *Iron & Steel*, v. 28, May 1955, p. 233-235.
- A method of assessment of charging delays. Table, graphs, diagrams. (D2)
- 210-D. Topochemical Aspects of Iron Ore Reduction.** Gust Bitsianes and T. L. Joseph. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, May 1955, p. 639-645.
- Topochemical behavior of reduction studied in six types of ores of different origin, composition and physical structure. Micrographs, graph. 16 ref. (D general, Fe)
- 211-D. Special Pig Irons for the Pacific Northwest.** John P. Walsted. *U. S. Bureau of Mines, Report of Investigations* 5120, Apr. 1955, 14 p.
- Small-scale tests have demonstrated that pig iron of any desired composition may be made by proper proportioning of the smelter charge, using materials available in this region. Tables. 2 ref. (D1, CI)
- 212-D. The Control of the Basic Converter Process by Utilizing the Thermal Radiation of the Bath and the Spectrum of the Converter Flame.** Franz Wever, Walter Koch, Horst Höfmann, Bernd Alexander Steinkopf, Helmut Knüppel, Karl Ernst Mayer and Gert Wielhoff. *Stahl und Eisen*, v. 75, no. 9, May 5, 1955, p. 549-559.
- Control of the reaction process by means of the temperature and spectrometer curve. Diagrams, graphs, micrographs. 10 ref. (D3)
- 213-D. (Polish.) Economizing on the Ferromanganese in the Melting of Steel.** L. Andrejew. *Hutnik*, v. 22, no. 1, 1955, p. 30-32.
- Less loss of manganese results from addition of ferromanganese to the teeming ladle instead of to the openhearth furnace. Chemical analyses and mechanical properties presented for steels thus deoxidized. Graphs, tables. (D2, D9, Q general, ST)
- 214-D. (Russian.) Influence of the Circulation of Coke on the Burning Process in Blast Furnaces.** I. P. Bardin, M. Ia. Ostroukhov, L. Z. Khodak and L. M. Tsylev. *Izvestia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1955, no. 1, Jan., p. 80-95 + 1 plate.
- Conditions of operation; changing composition of gases in the various zones of the furnace; effect of blast conditions. Diagrams, tables, graphs, photographs. 12 ref. (D1)
- 215-D. (Russian.) Behavior of Zinc in Blast Furnaces.** A. L. Zagianskii. *Izvestia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1955, no. 1, Jan., p. 96-108.
- Harmful effects of zinc; zoning and peculiarities of formation of zinc oxide; growth of the refractory lining; reactions of zinc in connection with the melting of materials containing zinc. Table. 25 ref. (D1, Zn)
- 216-D. Ingots and Ingot Production. II. Ingot Defects.** G. Reginald Bashforth. *British Steelmaker*, v. 21, May 1955, p. 146-150.
- Various defects which may arise and their probable causes. Particular attention is devoted to ingot cracks. Diagrams. 16 ref. (D9, ST)
- 217-D. Continuous Casting of Steel.** J. S. Morton. *British Steelmaker*, v. 21, May 1955, p. 152-157.
- General review covering the underlying aims and economic significance of the process, technical problems which have been encountered, operation of a typical plant, useful survey of all the known techniques evolved to date. Photograph, graph, diagram, table. 4 ref. (D9, ST)
- 218-D. Experimental Production of Pig Iron and Steel From Cominco Iron Concentrates.** B. G. Hunt, E. J. Kwasney, W. P. Campbell and S. L. Gertsman. *Canadian Mining and Metallurgical Bulletin*, v. 48, no. 517, May 1955, p. 281-291; *Canadian Institute of Mining and Metallurgy, Transactions*, v. 58, 1955, p. 147-157.
- Details are given of the steelmaking and fabrication procedure, of the visual and microscopic examination and of the extensive series of tests on the steel produced. Photographs, micrographs, diagrams, tables, graphs. 2 ref. (D general, Fe, ST)
- 219-D. Rapid Method of Relining a Blast Furnace.** Bruno Vezzani. *Iron and Steel Engineer*, v. 32, May 1955, p. 111-117; disc., p. 117-118.
- The unusually fast performance of relining this blast furnace was accomplished primarily because of excellent advance planning and wholehearted cooperation between the various groups on the job—as a result, relining of furnace was accomplished in the short time of 15 days 9½ hr. Tables, diagrams. (D1)
- 220-D. Evolution in Steel Melting.** E. C. Wright. *Metal Progress*, v. 67, June 1955, p. 100-101.
- Some technical and economic con-
- sideration that have directed attention to the disadvantages of the basic openhearth furnace operation. (D general, ST)
- 221-D. (French.) Contribution to the Study of Silicate Inclusions in Killed Steel.** R. Collée. *Revue universelle des mines*, v. 11, ser. 9, Apr. 1955, p. 151-156.
- A new hypothesis concerning the formation of silicate inclusions. Experimental proof. Micrographs, tables. 23 ref. (D general, ST)
- 222-D. (Russian.) Mechanism of the Desulfurizing of Iron.** I. L. Korkina, O. A. Esin and V. V. Mikhailov. *Doklady Akademii Nauk SSSR*, v. 101, no. 6, Apr. 21, 1955, p. 1065-1067.
- A critique of the theories of Chang, Goldman and others. Equations for reactions in the slag. Table, diagram. 4 ref. (D1, Fe)
- 223-D. (Russian.) Study of Wetting Ability of Slags in the Electric-Furnace Melting of Steel.** A. I. Khodatav, S. I. Suchil'nikov and I. P. Mal'kin. *Doklady Akademii Nauk SSSR*, v. 101, no. 6, Apr. 21, 1955, p. 1093-1096.
- Comparison of wettability of iron by synthetic and foundry slags. Determining the boundary angles of the wettability of a metal by a slag. Tables, graphs, diagrams. 9 ref. (D5, B21, ST, CI)

E

Foundry

214-E. Light Iron Castings and the New Die Pressing Process. R. S. M. Jeffrey. *American Foundryman*, v. 27, May 1955, p. 88-95.

Die pressing process for gutters and other castings produces low-cost, gray-as-cast iron in mechanized permanent molds. Tables, photographs, micrographs, diagrams. 10 ref. (E12, CI)

215-E. Stopping Blow-By in Core Boxes. Richard L. Olson. *American Foundryman*, v. 27, May 1955, p. 101-103.

Design of blow box with continuous dike-type seal. Photographs. (E21)

216-E. Die Lubricants—Facts and Fancies. H. K. Barton. *Machinery (London)*, v. 86, Apr. 29, 1955, p. 925-930.

Purposes of lubricants, substances used, application and direct effect of release agents. Photograph. (E13)

217-E. Cast Bolts for Pipe Joints. C. K. Donoho. *Metal Progress*, v. 67, May 1955, p. 86-88.

Cast bolts are mass produced in metal molds with short-cycle annealing; nuts are gray iron, shell molded. Photographs, micrograph, diagram. (E12, E16, CI)

218-E. (German.) Relation Between Viscous and Mechanical Properties of Bentonite. Heinz Siegel. *Giesserei*, v. 42, no. 8, Apr. 14, 1955, p. 176-186.

Physical and mechanical properties, possibilities for improvement, fields of application of bentonite molds. Tables, diagrams, photographs. 8 ref. (E18)

219-E. (German.) A New Sand Mold Binder. Heinz Busch. *Giesserei*, v. 42, no. 8, Apr. 14, 1955, p. 187-191.

Composition; optimum relation between sand and binder; physical and mechanical properties of finished molds. Tables, graphs, photographs. 2 ref. (E18)

220-E. (Italian.) Rational Designing of Castings. *Fonderia*, v. 4, no. 2, Feb. 1955, p. 49-50.

Presents ten points to be considered in the designing of quality cast iron pieces. Diagrams, photographs. (E general, CI)

221-E. (Russian.) Melting in a Cupola Furnace With a Chemically Basic Lining. L. I. Levi. *Litinoe Proizvodstvo*, 1955, no. 4, Apr., p. 3-8.

Desulfurization and dephosphorization processes; chemical composition and temperature of the cast iron; use of oxygen in the blast. Tables, graphs. 7 ref. (E10, CI)

222-E. Pinholing in Nodular Iron Castings. J. Gittus. *British Cast Iron Research Association, Journal of Research and Development*, v. 5, Apr. 1955, p. 594-603 + 4 plates.

Defect appears to be most pronounced in green sand-molded castings and can be alleviated both by additions of carbonaceous materials to the mold and by small additions to the metal of aluminum, tellurium and bismuth. A cerium addition is made to cancel any harmful effect due to these latter elements. Tables, diagrams, micrographs, photographs. 1 ref. (E25, CI)

223-E. Sinking Under Bosses on Thin Plates: Preliminary Experiments on Foundry Variables. I. C. H. Huches. *British Cast Iron Research Association, Journal of Research and Development*, v. 5, Apr. 1955, p. 616-627 + 4 plates.

Effects of melting and pouring temperatures, inoculation with ferrosilicon, molding practice and design variables upon sinking. Tables, photographs, graphs. (E25, CI)

224-E. Carbon-Dioxide Process. D. V. Atterton. *Foundry Trade Journal*, v. 98, May 12, 1955, p. 505-511; disc., p. 511-514.

Determining optimum additions of binder from point of view of strength by varying binder content when gassing cores for a constant time. Photographs, diagrams, graphs. (E19)

225-E. Carbon and Alloy Steel Castings. *Iron & Steel*, v. 28, May 1955, p. 189-194.

Plant and operating procedures of a British foundry. Photographs, diagrams. (To be continued.) (E11, CI)

226-E. Colloidal Graphite in the Foundry. W. A. Mader. *Modern Metals*, v. 11, May 1955, p. 40-41.

Unique properties make "Dag" dispersions ideal as chill coatings, mold wash, high temperature lubricants and parting compounds. Photographs. (E19)

227-E. Casting and Fabrication of High-Damping Manganese-Copper Alloys. J. A. Rowland, C. E. Armantrout and D. F. Walsh. *U. S. Bureau of Mines, Report of Investigations* 5127, Apr. 1955, 19 p.

Melting and casting; mechanical working and heat treating ingots. Graphs, photographs. 15 ref. (E general, F general, J general, Mn, Cu)

228-E. Investment Casting Gets Nod as Cost Saver for Parts. James B. Price. *Western Metals*, v. 13, May 1955, p. 49-51.

Precision casting equipment and procedures; advantages and applications. Photographs. (E15)

229-E. Foundry Practice. IX. The Molten Metal. William H. Salmon and Eric N. Simons. *Edgar Allen News*, v. 34, May 1955, p. 111-112.

Melting procedures for copper alloys and cast iron. Table. (To be continued.) (E10, CI, Cu)

230-E. Automated Molding Line. Robert H. Hermann. *Foundry*, v. 83, June 1955, p. 74-80.

Production methods for automated and semi-automated molding lines, as well as related foundry sections of a gray iron foundry. Photographs, diagrams. (E19, CI)

231-E. The CO₂ Process. Its Use in British Foundries. Arnold Tipper. *Foundry*, v. 83, June 1955, p. 84-90.

Methods and equipment for making cores and molds using sodium silicate binders hardened by carbon dioxide gas. Photographs, table, diagram. (E18)

232-E. Molding Simplified by Change in Pattern. William Ferguson. *Foundry*, v. 83, June 1955, p. 91.

Improved pattern design permits easier withdrawal of cast stainless steel extractor screw. Photograph. (E17, SS)

233-E. New Plant Helps Promote Die Casting Quality. Kenneth L. Mountain. *Foundry*, v. 83, June 1955, p. 100-103.

Plant equipment and operating procedures. Photographs. (E13)

234-E. Strainer Core—Types and Applications. *Foundry*, v. 83, June 1955, p. 123-124, 127.

Advantages, dimensions, selection criteria. Photograph, diagram, table. (E21)

235-E. Trouble Shooting, Designing a Small Cupola. C. W. Ammen. *Foundry*, v. 83, June 1955, p. 128 + 4 pages.

Determination of dimensions, equipment and construction features. Diagrams. (E10)

236-E. Rothfischer Centrifugal Iron Pipe Casting Machines. *Machinery (London)*, v. 86, May 13, 1955, p. 1034-1036.

Design of machine for casting water main pipes of various thicknesses. Photographs. (E14, CI)

237-E. Engineering Design Opportunities in Castings. (Digest of A.S.M. Lecture Course, "Why Castings", by Hans J. Heine; Presented before the Louisville, Ky., Chapter, Mar. 1955.) *Metal Progress*, v. 67, June 1955, p. 148, 150, 152.

Engineering design opportunities in castings. Includes choice of casting accuracy, finish, mechanical properties, alloys used. (E general)

238-E. Die Castings for Machine Parts. David Laine. *Tool Engineer*, v. 34, June 1955, p. 79-80.

Die cast machine components result in lower weight, reduced production and lower assembly costs because of the one-piece construction inherent in the die casting process. Photographs. (E13, Al, Zn)

239-E. (Czech.) The Adhesion of the Lead Bearing Alloy Overlay With the Steel Back. Vladimir Suchanek. *Hutnické Listy*, v. 10, no. 4, Apr. 1955, p. 221-228.

Effects of variations in alloy composition, temperature of the bearing metal and that of the steel shell, and the rate and direction of cooling. Photographs, graphs, micrographs, diagrams, tables. 7 ref. (E general, T7, Pb)

240-E. (Russian.) Feeding of Steel Castings Being Prepared by the Investment Casting Process. M. L. Khenkin. *Litinoe Proizvodstvo*, 1955, no. 5, May, p. 1-6.

Pouring and teeming systems with feeding of castings from risers, cylindrical and circular collectors and special heads; relation of casting dimensions to riser and feeder dimensions and design; avoidance of brittleness, settling cracks and other defects. Diagrams, graphs, table, nomograms. 6 ref. (E15, E23, CI)

241-E. (Russian.) Machine for Pressure Casting Nonferrous Metal Parts. D. M. Nabrovod and L. M. Sobolev. *Litinoe Proizvodstvo*, 1955, no. 5, May, p. 10-11.

Design specifications and operational characteristics of press and heater. Diagrams. (E13)

242-E. (Russian.) Experiment in the Modification of Cast Iron by Magnesium. S. I. Vitenson, R. S. Tripolskaya and R. I. Galaiko. *Litinoe Proizvodstvo*, 1955, no. 5, May, p. 18-19.

Chemical composition and specific weight of slags formed under different conditions of modification; use of various fluxes; chemical composition of different zones of the metal. Micrographs, photograph, tables. (E25, E10, CI)

F

Primary Mechanical Working

108-F. A New Approach to Metal-Forming Problems. E. G. Thomsen. *ASME, Transactions*, v. 77, May 1955, p. 515-521; disc., p. 521-522.

Describes method, gives stress and strain-rate distribution within a billet during an inverted extrusion process of a tube using commercially pure lead. Photographs, graphs, diagrams. 4 ref. (F24, Q24, Pb)

109-F. Wire-Drawing Machines for Steel Wire. H. Richards. *Iron and Steel Institute, Journal*, v. 180, May 1955, p. 60-65.

Types of wire drawing machine in use in the United Kingdom. Possible future developments towards increased speed and efficiency. (F28, ST)

110-F. Arc-Cast Molybdenum—Ingot to Bar, Sheet or Wire. N. L. Deuble. *Metal Progress*, v. 67, May 1955, p. 89-92.

Workability of ingots is determined largely by the molybdenum melting process. Photographs. (F general, Mo)

111-F. The Fabrication of Arc-Melted Ingots of Titanium and Titanium-Manganese Alloys Into Plate. R. W. Huber, V. C. Petersen and R. C. Wiley. *U. S. Bureau of Mines, Report of Investigations* 5117, Mar. 1955, 35 p.

Various steps in fabricating the materials into finished plate; comparative mechanical tests; response of the titanium-manganese alloy to various heat treatments. Graphs, tables, micrographs. 8 ref. (F23, Ti, Mn)

112-F. Experimental Extrusion of Aluminum Cable Sheath at Bell Telephone Laboratories. G. M. Bouton, J. H. Heiss and G. S. Phipps. *Bell System Technical Journal*, v. 34, May 1955, p. 529-561.

New techniques for extruding directly over paper insulated cable core at low temperature and pressure. Graphs, micrographs, diagrams, photographs, table. 8 ref. (F24, Al)

113-F. Application of Statistical Methods to Gauge Control in Rolling Aluminum Sheets. T. Bose. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 137-143.

Control of gage variation at final rolling stage. Tables, diagrams. (F23, Si2, Al)

114-F. Fabrication of Titanium Components. Arnold S. Rose. *Jet Pro-*

pulsion, v. 25, May 1955, p. 212-216, 234.

Titanium alloys; forming operations; forging; spinning; welding. Photographs, graphs, diagrams. (F general, G general, K general, Ti)

115-F. Extrusion Through Wedge-Shaped Dies. I-II. W. Johnson. *Journal of the Mechanics and Physics of Solids*, v. 3, Apr. 1955, p. 218-230.

Experimental data of the steady-state pressure for the direct extrusion of sheet under strain conditions through square and wedge-shaped dies. Variation of extrusion pressure with friction, for selected reductions of small angle dies. Diagrams, graphs. 7 ref. (F24)

116-F. Two Decades of Progress in Drop Forging. H. J. Merchant. *Metal Treatment and Drop Forging*, v. 22, May 1955, p. 211-218.

Developments and advances made in the forging industry. Photographs, diagrams. 15 ref. (To be continued.) (F22)

117-F. Procedures for Forming Stainless Steel Tubing. *Metal-Working*, v. 11, June 1955, p. 14-16.

Methods of forming, reducing, expanding, flaring and rolling threads. Diagrams, photographs. (F26, SS)

118-F. Giant Forge Presses Go Into Action. *Modern Metals*, v. 11, May 1955, p. 84, 86, 88.

Large hydraulic units for production of aluminum aircraft forgings. Photographs, diagram. (F22, Al)

119-F. Steel Shell Manufacture. Arthur F. MacCochie. *Ordnance*, v. 39, May-June 1955, p. 995-998.

Considers pros and cons of hot forging and cold forming. Table, photograph, diagram. (F22, G4)

120-F. (French.) The Study of Forgeability. Very. *Centre de Documentation Siderurgique, Circulaire d'Informations Techniques*, v. 12, no. 4, 1955, p. 783-800.

Control of forgeability of stainless and high temperature steels, and a new type of testing equipment for determining forgeability. Photographs, tables, diagrams. (F22, SS)

121-F. (Polish.) The Principles of Fastening Dies in Hammers. Wieslaw Wroblewski. *Hutnik*, v. 22, no. 1, 1955, p. 13-20.

Designs of drop hammers and dies, types of locking arrangements, wedges and inserts. Design factors consider function, size of hammer, strength of blow, hardness and types of steel. Diagrams, tables. 6 ref. (F22, ST)

122-F. Cold Reduction Facilities at Fairless Works. Robert R. Shedd. *Iron and Steel Engineer*, v. 32, May 1955, p. 55-62; disc., p. 62-63.

Plant layout, operating economies, equipment details. Diagrams, tables, photographs. (F23, CN)

123-F. Plate Mill Design and Rolling Practice. Elmer Lynch. *Iron and Steel Engineer*, v. 32, May 1955, p. 91-95; disc. 95-96.

Plate mill consists of a 24 x 36 x 116-in., three-high rougher and a 36 x 54 x 130-in., four-high finishing mill; slabs are kept in process in both mills simultaneously; some plates can be finished on the three-high mill and the combination gives excellent operating flexibility. Tables, photographs. (F23, CN)

124-F. Characteristics of Tandem Mill Drives. R. G. Beadle. *Iron and Steel Engineer*, v. 32, May 1955, p. 97-102; disc., p. 102-103.

Developments in electrical equipment. Comparison of two magnetic amplifier systems. Diagrams, graphs, table. (F23, CN)

125-F. Screwdown Lubrication. William A. Holt. *Iron and Steel En-*

gineer, v. 32, May 1955, p. 119-120; disc., p. 120-121.

Use of lead naphthenate lubricants on rolling mill screwdown screws and nuts. (F23)

126-F. Induction Heating of Ingots Proved Practical for Rolling. M. C. D. Hobbs. *Iron and Steel Engineer*, v. 32, May 1955, p. 123-124, 126, 129.

Induction heating and materials handling equipment for rolling mill. Photographs, diagram, table. (F21, F23, CN)

127-F. Problems of Forging Aluminum. *Machinery Lloyd (Overseas Ed.)*, v. 27, May 7, 1955, p. 93-95.

Maintaining internal stresses at a minimum value by quenching in water with temperature above 85°C. Diagrams, photographs, graphs. (F22, Al)

128-F. G.F.M.: Precision Forging Machines. *Machinery (London)*, v. 86, May 13, 1955, p. 1028-1030.

Hot forging machine for forming the flutes in carbon steel and high speed steel taps ranging from 3% to 19/16 in. diam. Photographs. (F22, ST)

129-F. Arc-Cast Molybdenum—Fabrication of Parts. N. L. Deuble. *Metal Progress*, v. 67, June 1955, p. 101-105.

General characteristics that govern mechanical properties and successful working methods. Photographs, table, diagram. 6 ref. (F general, G general, Q general, Mo)

130-F. Lubricants for Wiredrawing. A. L. H. Perry. *Scientific Lubrication*, v. 7, May 1955, p. 14-18.

Advances have required improved drawing lubricants, and future increases in drawing speeds likewise largely depend on improving lubricants still further. Photographs. 5 ref. (F1, F28)

131-F. Upset forgings. Modern Methods and Design. I. M. W. Lamprecht. *Steel Processing*, v. 41, May 1955, p. 295-304.

Use of forged products, steps to be followed in manufacturing dies, single and multiple operations, high explosive shell cases. Table, diagrams. (F22)

132-F. (Czech.) Change of Tube Wall Thickness in Drawing. Bohumil Pocta. *Hutnické Listy*, v. 10, no. 4, Apr. 1955, p. 194-200.

Results show that the change of wall thickness depends on the ratio between wall thickness and tube diameter before drawing. Table, graphs, diagrams. 6 ref. (F26)

133-F. (French.) Forged and Stamped Parts of Aluminum Alloys. II. Forging. Robert Colomb. *Revue de l'Aluminium*, v. 32, no. 219, Mar. 1955, p. 281-296.

Techniques for A-U4G, A-S12UN and A-U2GN alloys of different structural parts and their mechanical characteristics. Tables, diagrams, photographs. (F22, G3, Al)

134-F. (Russian.) Economic Efficiency of the Induction Heating of a Metal During Drop Forging on Crank-Driven Presses. V. S. Bialkovskaya. *Vestnik Mashinostroenia*, v. 35, no. 5, May 1955, p. 72-77.

Comparison of costs of induction heating and flame heating under various conditions and for various machine parts. Oil, natural gas and producer-gas costs. Tables, graph. (F21, F22, ST)

NATIONAL METAL CONGRESS NATIONAL METAL EXPOSITION

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October 17-21, 1955

G

Secondary Mechanical Working

131-G. Cold Working of Metals. J. G. Wistreich. *Iron and Steel Institute, Journal*, v. 180, May 1955, p. 51-59.

Particular importance is attached to concept of tool-stock configuration and its role in determining the properties of end products, tool loads and machine size. Diagrams, micrographs, graphs. 23 ref. (G general)

132-G. Milling Goes Chemical. *Steel*, v. 136, May 16, 1955, p. 120-121.

Used for jobs on which mechanical milling is slow or difficult. Photographs. (G17, Al)

133-G. (French.) Better Cutting at a Better Price. H. Bertault and J. P. Hubert. *Revue de la soudure (Brussels)*, v. 11, no. 1, 1955, p. 16-26.

Methods of lowering oxygen and acetylene consumption and of improving cutting section in a given period of time. Diagrams, photographs, table. (G22)

134-G. (Russian.) Automatic Regulation of Cutting Speed in Relation to the Temperature of the Cutting Edge of the Cutter. P. N. Malakhov. *Vestnik Mashinostroenia*, v. 35, no. 4, April 1955, p. 26-30.

Automatic apparatus and circuit, mode of operation, and its testing for industrial use. Circuit diagram, graphs, photograph, table. 2 ref. (G17, CI, ST)

135-G. (Russian.) Derivation of the Criterion of Interaction of Electrode Substances During the Electrospark Finishing of Metals. G. V. Gusev. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 763-765.

Physical constants of the electrodes and parameters of the impulse electrical discharge. 5 ref. (G17)

136-G. Cope Talks on Draw Dies. XXVIII. Drawing Dies for Stainless Steel Requirements. Stanley R. Cope. *American Machinist*, v. 99, May 23, 1955, p. 130-132.

To avoid scratches and score marks on deep-drawn stainless steels or nickel alloys, choose die materials with suitable characteristics. Diagrams. (G4, SS, NI)

137-G. Continuous Blank Machining in Gear Production. J. J. McCabe. *Automation*, v. 2, June 1955, p. 26-29.

Precision boring using parts handling mechanisms and gage actuated tool setting controls. Photographs, diagram. (G17)

138-G. Electronic Consideration in the Theory and Design of Electric Spark Machine Tools. Everard M. Williams and James B. Woodford, Jr. *Institute of Radio Engineers, Transactions on Industrial Electronics*, PGIE-2, Mar. 1955, p. 78-81.

Process used, dielectric, type of pieces machined and techniques of current generation. Photographs, circuit diagram. 3 ref. (G17)

139-G. How to Understand Cold Working of Metals. Samuel Storchheim. *Metalworking Production*, v. 99, May 13, 1955, p. 845-851.

Effects of prior processing on the metal, its grain structure and work hardening rate. Graphs, photographs, micrographs, tables. (G general)

140-G. Mechanization Applied to Oxygen Cutting. R. L. Dally. *Welding Journal*, v. 34, May 1955, p. 433-439.

Automatic material handling equipment and electrical controls for routine high-quantity production of precision work. Photographs, graphs. (G22)

141-G. Automated Setup for Handling of Workpieces in Ford Transmission Plant. *Automotive Industries*, v. 112, June 1, 1955, p. 68-69, 122, 124.

Equipment and procedures for automatic control of machine tools for production of gears and shafts. Photographs, diagram. (G17, A5)

142-G. Machining Hard Materials by Ultrasonics. *Canadian Metals*, v. 18, May 1955, p. 45-46.

Equipment and operating procedures. Diagram, table, photograph. (G17)

143-G. The Grinding of Steel. XXV. Grinding and Finishing Machines. Edgar Allen News, v. 34, May 1955, p. 109-110.

Description, operating techniques and capabilities of internal grinding machines. Photograph. (To be continued.) (G18, ST)

144-G. Cold Extrusion Marches On. II. Materials, Lubrication, Tooling, Pressures and Production Information. James M. Leake. *Finish*, v. 12, June 1955, p. 39-40, 86, 88.

Advantages and processes. (G5, CN)

145-G. "Start From Scratch" Savings. Howard E. Jackson. *Modern Industrial Press*, v. 17, May 1955, p. 13 + 7 pages.

Description of a compact and highly efficient steel fabricating unit. Photographs. (G general, CN)

146-G. Coated Abrasive Machines in Close Tolerance Work. A. W. Bell. *Modern Machine Shop*, v. 28, June 1955, p. 106-109.

Outstanding production applications of coated abrasive machinery capable of removing metal rapidly to extremely exacting tolerances. Photographs. (G18)

147-G. New Machine Extends Thread Rolling Process. *Modern Machine Shop*, v. 28, June 1955, p. 128-131.

Two-roll design principle is applicable to wide range of workpieces. Photograph, diagrams. (G12)

148-G. Reclamation of Used Oils. V. Cutting Oils and Coolants. E. G. Ellis. *Scientific Lubrication*, v. 7, May 1955, p. 19-25.

Treatment of cutting oils and coolants and the disposition and treatment of swarf. Photographs, diagram. (G21)

149-G. Sectional Dies. Federico Strasser. *Sheet Metal Industries*, v. 32, no. 337, May 1955, p. 339-343, 384.

Some aspects of their design, construction and use. Diagrams. (G1)

150-G. Shot Peening for Safety. *Steel*, v. 136, May 23, 1955, p. 102-103.

Improving fatigue strength of materials at points of greatest stress. Photographs. (G23, Q7)

151-G. Precision Contour Rolling Teams With Welding to Produce Steel Propellers. A. E. Felt. *Steel Processing*, v. 41, May 1955, p. 305-309.

Contour rolling, fabrication, heat treating, finishing and balancing of steel propeller blades. Photographs, diagrams. (G11, K general, T24, ST)

152-G. The Design of Simple Dies for Bending Operations. W. M. Halliday. *Steel Processing*, v. 41, May 1955, p. 311-314, 331.

Problems of the tool designer concerning questions of die-design and

construction; the particular principles of bending action to be employed; what portions of the component shape are to be reproduced in each die; how many dies have to be used; and how such tooling or production costs may be maintained as low as possible. Diagrams. (G6)

153-G. Slow Speed Sawing—Reports on a Growing Technique. *Steel Processing*, v. 41, May 1955, p. 317-318.

Inexpensive box strapping and clock spring material will cut stainless steels, mild steels and titanium. Photographs. (G17)

154-G. Wet Machining of Cast Iron Increases Tool Life. John A. Boyd. *Tool Engineer*, v. 34, June 1955, p. 81-82.

Best current solution to cast iron machining problems is the use of a high-wetting and dispersing water soluble compounds with special rust-inhibiting additives. Photographs. (G17, CI)

155-G. How to Select and Use Die Steels. *Tool Engineer*, v. 34, June 1955, p. 97-99.

Some of the important considerations in choice of die materials. Diagrams, tables. (G17, T5, TS, AY)

156-G. Analysis of Ear Formation in Deep-Drawn Cups. Arthur J. McEvily, Jr. U. S. National Advisory Committee for Aeronautics, Technical Note 3439, May 1955, 7 p.

A method for predicting earing behavior proposed, based on the plastic properties of single crystals and a knowledge of the preferred orientation of the blank material. Proposed method of prediction is in agreement with reported experimental results. Graphs, diagrams. 7 ref. (G4)

157-G. (Russian.) Method of Calculating the Relative Economy of Different Operations by Oxygen Cutting. S. G. Guzov. *Svarochnoe Proizvodstvo*, 1955, no. 5, May 1955, p. 9-11.

Calculative factors include thickness of steel to be cut, cost of operation of gas cutter, whether cutting is straight or figure, etc. Graphs, table. (G22, ST)



Powder Metallurgy

125-H. (Polish.) Obtaining and Sintering of Molybdenum Silicide. W. Rutkowski. *Hutnik*, v. 22, no. 1, 1955; *Buletyn Informacyjny Instytutu Ministerstwa Hutnictwa*, v. 6, no. 1, 1955, p. 1-3.

Microstructure and hot-gas corrosion of molybdenum silicide sintered at 1400°C. Comparisons with other alloys. Micrographs, photographs. (H15, Mo, SI)

126-H. Powder Metallurgy. American Society for Naval Engineers, Journal, v. 67, May 1955, p. 521-532.

Manufacturing, properties and testing of iron, ferrous alloy, and nonferrous metal powders; principles and control of compacting and sintering; manufacturing and properties of structural engineering components; powder metallurgy of high-melting point materials. Table, photograph. (H general)

127-H. The Sintering, Fabrication, and Properties of Thorium. M. D. Smith and R. W. K. Honeycombe. *Institute of Metals, Journal*, v. 83, May 1955, p. 421-426.

Systematic data on the sintering and working of relatively pure thorium as the first steps in a program

of work on the properties of thorium-base alloys. Graphs, table. 15 ref. (H15, Th)

128-H. Metal Powder Components for Motor Vehicles. D. B. Martin. *Machinery (London)*, v. 86, May 6, 1955, p. 975-979.

Parts can be made to close dimensional tolerances by molding the powders in accurate dies and controlling the shapes of the compacts during heat treatment. Diagrams, photographs. (H14, J general)

129-H. Powder Metallurgy for Atomic Engineers. (Digest of "The Role of Powder Metallurgy in the Design of Nuclear Power Reactors", by Henry H. Hausner and Milton C. Kells; presented before the April 1955 meeting of the American Society of Mechanical Engineers.) *Metal Progress*, v. 67, June 1955, p. 167-168, 170.

The way structural units, made by powder metallurgical methods, may be expected to differ from those made by conventional methods when exposed to conditions within a power reactor. (H general, T25)

130-H. (Book.) Symposium on Testing Metal Powders and Metal Powder Products. ASTM Special Technical Publication No. 140, 87 p. 1953. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Applications and improved compositions, testing methods, and particle size distribution. (H general)



Heat Treatment

107-J. (German.) Steel Castings for Double-Duro Hardening. Hans Wilhelm Grönegress. *Gießerei*, v. 42, no. 8, Apr. 14, 1955, p. 170-175.

Optimum composition; influence of carbon content on hardenability; heat treatment; fields of casting applications. Photographs, table, graphs, micrographs. 7 ref. (J general, T general, CI)

108-J. (Russian.) Nitriding of Magnesium Cast Iron. V. D. Iakhnina. *Litinoe Proizvodstvo*, 1955, no. 4, Apr., p. 23-25.

Corrosion tests, porosity, brittleness, microhardness, depth of nitrided layer. Heat treatment of nitrided metal. Graphs, micrographs, tables. 4 ref. (J28, CI)

109-J. (Russian.) Prevention and Correction of Defective Pieces During the Heat Treatment of Cutting Tools. I. E. Khelimskii and Z. I. Fel'dshtain. *Stanki i Instrument*, v. 26, no. 3, Mar. 1955, p. 22-25.

Quenching and annealing treatments, welding of cutting tools, weld inspection methods. Tables, diagrams. (J26, J23, K general, TS)

110-J. (Russian.) Strengthening of Machine Parts by the Electrode-Spark Method. L. A. Mirkin. *Vestnik Mashinostroenia*, v. 35, no. 4, Apr. 1955, p. 48-51.

Electrodes used, hardness and wear resistance of surfaces hardened, advantages. Graphs, table, diagram. (J28, ST, CI)

111-J. Viewpoints on the Linde Method of Stress Relieving. R. Gunnert. *British Welding Journal*, v. 2, May 1955, p. 200-204.

Effectiveness of the method in reducing transverse stresses and the

- extent to which longitudinal stresses can be reduced. Graphs, table. 11 ref. (J1)
- 112-J.** Some Considerations of the Action of Energizers in Solid Carburising Agents. H. Schrader. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 61-78; disc., p. 78-80.
- Composition of solid carburizing agents and types of common additions used for energizing. Tables, graphs. 11 ref. (J28)
- 113-J.** Heat Treating Precision Equipment for Aircraft. Frank Craven. *Industrial Gas*, v. 33, May 1955, p. 5-7, 24.
- Versatile batch-type furnaces provide part and process flexibility required for heat treating about 800,000 lb. of precision electrical, hydraulic and mechanical components on job-lot basis. Photographs. (J general)
- 114-J.** Continuous Car Bottom Furnaces. Walter J. Assel. *Industrial Heating*, v. 22, Apr. 1955, p. 732 + 4 pages.
- Continuous car bottom versus roller hearth, rotating hearth and pusher-type furnaces. Photographs. (J general)
- 115-J.** Salt Bath Furnace Performs Four Different Operations. E. W. Kerman. *Iron Age*, v. 175, May 19, 1955, p. 124-126.
- First intended for carburizing only, is now doing three other jobs—simultaneous brazing and carburizing, brazing and hardening. Photographs. (J2)
- 116-J.** Using Dew Point for Automatic Control of Heat Treatment Atmospheres. Peter Trippie. *Metalworking Production*, v. 99, May 13, 1955, p. 861-863.
- Recently developed system to facilitate automatic control of furnace atmosphere in heat treatment processes by detecting and controlling the dew point and therefore the carbon potential. Photographs, graphs. (J2)
- 117-J.** The Heat Treatment and Working of Haynes 25 Alloy. H. A. Blank, A. M. Hall, J. H. Jackson, J. W. Frank, and W. K. Anderson. U. S. Atomic Energy Commission, BMI-814, 1953, 31 p.
- Primary objectives were to determine the upper limit of hardness, produced by cold working, at which Haynes 25 alloy can be satisfactorily machined, and the aging conditions that produce the highest hardness in the alloy. Corollary objectives were to improve the alloy's machinability and response to aging, as well as its wear resistance, by adjustment of composition. Graphs, tables, photographs. (J27, GI7, SG-m)
- 118-J.** (Dutch.) Interrupted Quench Hardening of Steel. C. H. Luiten. *Smit Mededelingen*, v. 10, no. 1, Jan.-Mar. 1955, p. 26-32.
- Practical applications when hardening high speed steel, hot work steel, and low-alloyed steel; survey of different hot quenching baths. Particular attention is paid to a salt bath with built-in propeller-agitator, cooler and special salt strainers. Graphs, photographs. 17 ref. (J26, ST)
- 119-J.** (German.) Vertical Heat Treatment Furnaces for Metal Bands. Friedrich C. L. Eischenmeyer. *Zeitschrift für Metallkunde*, v. 46, no. 4, Apr. 1955, p. 264-268.
- Description and structural details. Diagram, photographs. (J general)
- 120-J.** Laboratory Workshop Practice. VI. Heat Treatment of Steels. A. Thompson. *Laboratory Practice*, v. 4, May 1955, p. 202-206.
- In the laboratory the openhearth method is generally used for the hardening of small tools because of its cheapness and comparative convenience. Tables, diagrams. (J26)
- 121-J.** Heat Treating Aluminum Alloy Aircraft Parts—A Builder's Viewpoint. R. H. Gassner. *Metal Progress*, v. 67, June 1955, p. 75-79.
- How metallurgical principles dictate the requirements of heat treating equipment for wrought aluminum alloys. Graphs, photographs. (J general, AL)
- 122-J.** An Alloy Manufacturer's Viewpoint. K. B. Baker. *Metal Progress*, v. 67, June 1955, p. 80.
- A discussion of the need for adequate heating and cooling equipment in heat treating aluminum and magnesium alloy parts. (J2, AL, Mg)
- 123-J.** Furnaces for Heat Treating Aluminum and Magnesium. D. W. Pettigrew. *Metal Progress*, v. 67, June 1955, p. 81-83.
- Four major factors influence design of furnaces for heat treatment of aluminum and magnesium: temperature control, heat input, material handling and atmosphere requirements. Present high production rates have increased the importance of material handling. Photographs, diagram. (J general, A5, AL, Mg)
- 124-J.** Salt Bath Furnaces for Aluminum. Bernard P. Planner. *Metal Progress*, v. 67, June 1955, p. 84-86.
- Salt baths offer many advantages for heat treatment of aluminum aircraft alloys, including high treating rates, close temperature control, freedom from atmosphere attack. Graphs, diagram, table, photograph. (J2, AL)
- 125-J.** Surface Protection of Titanium and Stainless Steel During Heat Treatment. Horace Drever. *Metal Progress*, v. 67, June 1955, p. 87-90.
- Vacuum furnaces have proved successful in preventing embrittlement of titanium during annealing. Extremely dry hydrogen is being used successfully in both bright hardening and bright annealing of stainless steels. Photographs, table. (J2, Ti, SS)
- 126-J.** Controlled-Atmosphere Furnaces. Carl L. Ipsen. *Metal Progress*, v. 67, June 1955, p. 91-95.
- Survey of the representative types of controlled-atmosphere furnaces, their advantages and major fields of application. Photographs. (J2)
- 127-J.** Gas Combustion Equipment. A. D. Wilcox. *Metal Progress*, v. 67, June 1955, p. 95-99.
- Important properties of commercial gases that affect combustion and a description of the basic combustion systems being used in industry. Tables, graphs, diagrams. (J general)
- 128-J.** Tunnel Furnace Is Low-Cost Annealer. *Steel*, v. 136, May 30, 1955, p. 78.
- By designing out overhead cranes and special car-return mechanism, a lightweight metal building was sufficient. Car bottoms hold 1400 lb. per linear ft. of hearth. Photographs. (J23, ST)
- 129-J.** Annealing Control Makes the Difference. Edward J. Moritz. *Steel*, v. 136, May 23, 1955, p. 104-105.
- Roller-hearth furnace assures uniform high quality electrical steel. Annealing costs are no higher than those of former batch-furnace method. Photograph, flow chart. (J23, AY)
- 130-J.** Fast Quench Reduces Heat Treat Distortion. George Perkins and H. D. Bitner. *Tool Engineer*, v. 34, June 1955, p. 108-110.
- Use of the salt quench technique to solve problems of distortion of heat treated parts. Photographs. (J2, Al, AY)
- 131-J.** Gas Carburizing. L. G. W. Palethorpe. *Wild-Barfield Heat-Treatment Journal*, v. 5, Mar. 1955, p. 8-12.
- Theory, equipment, procedures. Graph, micrographs. 7 ref. (J28)
- 132-J.** Heat Treatment and Finishing Operations in the Production of Copper and Aluminium Rod and Wire. I. H. J. Miller. *Wire Industry*, v. 22, May 1955, p. 495, 498-500, 502.
- Influence of early processing operations on the properties of the final product. Copper wire annealing furnaces and methods. Table, graph. (J23, Al, Cu)
- 133-J.** (Czech.) Contribution to the Structure of Layers Treated by Means of Electric Sparks. Miroslav Cermak. *Hutnické Listy*, v. 10, no. 4, Apr. 1955, p. 215-221.
- Best treatment of steel surface will result when using electrodes made from sintered titanium and tungsten carbides. Tables, graphs, micrographs. 7 ref. (J28)
- 134-J.** (Polish.) Interoperational Annealing of 13% Chromium Stainless Steel. Z. Wojcik. *Hutnik*, v. 22, no. 2, Feb. 1955; *Buletyn Informacyjny, Instytutu Ministerstwa Hutnictwa*, v. 6, no. 2, 1955, p. 5-7.
- Isothermal annealing; dilatometric and metallographic investigations. Heat treatment on laboratory and quasi-industrial scale. Micrographs, graphs, tables. (J23, N8, SS)
- 135-J.** (Russian.) New Methods of Heat Treatment and Chemico-Thermal Treatment of Metal in Salt Baths. A. I. Zot'ev. *Vestnik Mashinostroenia*, v. 35, no. 5, May 1955, p. 67-71.
- Review of reports on bright dip, bright annealing, variations of the wire patenting process, sulfiding and use of carnallite as heating and cooling media. (J2, ST)

Joining

192-K. Butt-Welding Rings for Gas Turbines. *Machinery (London)*, v. 86, Apr. 29, 1955, p. 919-924.

Lengths of extruded sections are formed into rings by conventional methods in preparation for the flash butt welding operation. Photographs. (K3, SS)

193-K. Welding Cracks in Columbium-Bearing Stainless Steel. *Metal Progress*, v. 67, May 1955, p. 109-111.

Modifications in welding rod and base metal compositions and improved welding techniques have considerably reduced their occurrence. Micrographs. 1 ref. (K1, SS)

194-K. Weldability of Low-Alloy Vanadium Steels. (Digest of "Weldability of Twelve Low-Alloy Steels Containing Vanadium" by B. J. Bradstreet; *Welding Research*, v. 7, Oct. 1953, p. 107r-110r.) *Metal Progress*, v. 67, May 1955, p. 180, 182, 184.

Previously abstracted from original. See item 41-K, 1954. (K9, AY)

195-K. (French.) Examination of Some Problems Raised by the Arc Welding of Large Soft Steel and Alloy Steel Pieces in the Construction of Modern Machines. A. Lüthy. *Revue de la soudure (Brussels)*, v. 11, no. 1, 1955, p. 1-15.

Preparation and assembling of pieces before welding; heat treatments before, during and after welding; electrodes; control of welded

- heads. Photographs, micrographs. (K1, J general, AY, ST)
- 196-K. (German.) Investigation of Adhesive-Bonding of Metals. G. Kaliske. *Aluminium*, v. 31, no. 4, Apr. 1955, p. 151-156.
- Effect of degree of overlap, tensile strength of sheet, its thickness and surface condition, width of test specimens on bonding strength; corrosion resistance, tensile and fatigue strength under stress cycling of the bonds; nature of the hardened adhesive. Graphs. 30 ref. (K12)
- 197-K. (Russian.) Cold Welding of Aluminum and Copper Conductors. K. K. Khrenov and G. P. Sakhatskii. *Svarochnoe Proizvodstvo*, 1955, no. 4, Apr., p. 1-4.
- Instruments and techniques; strength properties of cold welds. Photographs, diagrams, table. (K5, Q23, Al, Cu)
- 198-K. (Russian.) Resistance Welding of Pipes in a Protective (Gas) Medium. N. S. Kabanov. *Svarochnoe Proizvodstvo*, 1955, no. 4, Apr., p. 5-9.
- Microstructure and strength properties of welds. Tables, diagram, micrographs. 3 ref. (K3, M27, ST)
- 199-K. (Russian.) Formation of Pores During Welding, by a Melting Electrode, in Protective Gases. N. M. Novozhilov. *Svarochnoe Proizvodstvo*, 1955, no. 4, Apr., p. 9-13.
- Rust was found to be the cause of pore formation. Tables, chart, photographs. 7 ref. (K1, ST)
- 200-K. Adhesives and Adhesive Bonding of Metals and Plastics. II. George Epstein. *Adhesives & Resins*, v. 3, Mar. 1955, p. 64-72.
- Adhesives in sandwich construction; adhesive bonding, procedures and requirements. Photographs, table. 3 ref. (K11)
- 201-K. Hard Soldering. R. C. Jewell. *Automobile Engineer*, v. 45, May 1955, p. 213-216.
- Thessal process for aluminum and aluminum alloys. Photographs, tables. (K7, Al)
- 202-K. A Further Examination of the Welding and Tensile Properties of Some Al-Zn-Mg Alloys Containing Copper. W. I. Pumphrey and D. C. Moore. *British Welding Journal*, v. 2, May 1955, p. 206-215.
- Extent of the heat-affected zones produced by oxy-acetylene and argon-arc welding in fully heat treated alloys; effect on weld cracking using filler-rod alloys. Tables, photographs, graphs. 6 ref. (K1, K2, Q23, Al, Zn, Cu, Mg)
- 203-K. A High Temperature Structural Adhesive. S. E. Susman. *Society of the Plastics Industry, Reinforced Plastics Division, Ninth Annual Technical & Management Conference, Proceedings*, 1954, sec. 7-I, 10 p.
- Physical properties and versatility of the resulting adhesive in processing and application to production materials and use. Table, diagrams, graphs, photographs. (K12, P general)
- 204-K. Applications of Argonaut Welding to Carbon Steel. R. L. Fanner and V. C. Herbert. *Welding and Metal Fabrication*, v. 23, May 1955, p. 161-165.
- Development of a suitable filler wire and gas mixture; welding technique for use on certain grades of killed and semi-killed mild steel. Radiographs, micrographs, photographs. (K1, CN)
- 205-K. Stainless Steel Fabrication Saves £350,000. Thomas A. Dickinson. *Welding and Metal Fabrication*, v. 23, May 1955, p. 166-168.
- Use of inert gas-shielded arc welding equipment for fabrication of stainless steel rings. Photographs, diagrams. (K1, SS)
- 206-K. Welding Developments in Germany. I. C. Fritz. *Welding and Metal Fabrication*, v. 23, May 1955, p. 169-176.
- Growth of welding practices in recent years. Photographs. (K general)
- 207-K. Hard Soldering of Aluminium and Aluminium Alloys by the Thessal Process. R. C. Jewell. *Welding and Metal Fabrication*, v. 23, May 1955, p. 179-182.
- Improved method of joining, not involving fusion of the parent metal, to fill the gap between the existing methods of soft soldering operating at 250° C. or less, and brazing operating at approximately 600° C. Photographs, tables. (K7, Al)
- 208-K. Hardenability Evaluation of Welding Electrodes. Leo M. West. *Welding Journal*, v. 34, May 1955, p. 399-404.
- Evaluation of mechanical properties of alloy steel weld deposits after heat treatment. Photographs, graphs, diagrams, tables. (K1, Q29, AY)
- 209-K. Semi-Automatic Multiple Flame Brazing Larger Brass Electronic Components. J. W. Weyers. *Welding Journal*, v. 34, May 1955, p. 405-412.
- Equipment and methods for brazing rectangular brass tubing to heavy brass flanges. Photographs, graphs, diagrams. (K8, Cu)
- 210-K. Fusion Welding Unalloyed Titanium Sheet Without Filler Rod. Alan V. Levy and Robert Wickham. *Welding Journal*, v. 34, May 1955, p. 413-419.
- Welding procedures and equipment; properties of welds. Photographs, tables. (K1, Ti)
- 211-K. Oscillographic Instruments in Spot Welding Quality Control and Maintenance. Glenn Woodnancy. *Welding Journal*, v. 34, May 1955, p. 425-432.
- Cathode-ray oscilloscope and direct writing magnetic oscilloscope are useful and necessary tools for welder maintenance under a high requirement quality control program. Photographs, graphs. 8 ref. (K3)
- 212-K. Iron-Powder Electrodes—A Progress Report. Jerry Hinkel. *Welding Journal*, v. 34, May 1955, p. 440-445.
- Review of first year's history of iron-powder electrodes and summary of the experience that has been gained since their introduction. Photographs, diagrams. (K1)
- 213-K. Further Studies of the Flash Welding of Steels. E. F. Nippes, W. F. Savage, G. Grotke and S. M. Robelotto. *Welding Journal*, v. 34, May 1955, p. 223S-240S.
- Weld centerline rates of cooling at 900, 1000 and 1300° F. in flash welds in AISI 1020 and 4340 steels, prepared under similar conditions, measured and compared. Cooling rate is not influenced by the composition of the steel if the specimen geometry, platen acceleration, and final clamping distance are maintained constant. Tables, graphs. 11 ref. (K3, AY)
- 214-K. The Flash Welding of Commercial Molybdenum. II. E. F. Nippes and W. H. Chang. *Welding Journal*, v. 34, May 1955, p. 251S-264S.
- Production and testing of flash welds of molybdenum; optimum values of upset distance assists in eliminating entrapped oxide in arc-cast and sintered molybdenum and reduces carbide precipitation in arc-cast molybdenum. Special consideration is needed for the higher carbon arc-cast molybdenum. Micro-
- graphs, photographs, tables, diagram, graphs. 4 ref. (K3, Mo)
- 215-K. (Dutch.) High-Frequency Welding Machine. K. K. Zwart. *Smit Mededeelingen*, v. 10, no. 1, Jan.-Mar. 1955, p. 7-15.
- Machine includes high-frequency apparatus to prevent extinction of the arc. Diagrams, graphs, table. (K1)
- 216-K. (French.) Welding of Light Alloys in Automotive Production (Application to the 1954 Dyna-Panhard). A. Bernier. *Soudage et Techniques Connexes*, v. 9, nos. 1-2, Jan.-Feb. 1955, p. 17-31.
- Welding of aluminum-3% magnesium alloy used for car bodies under conditions of mass production. Methods and installation. Tables, diagrams, photographs. (K general, Al)
- 217-K. (Hungarian.) Investigation of the Solder of the Silver-Copper Group. Ilona Waldhauser. *Kohászati Lapok*, v. 10, no. 4, Apr. 1955, p. 176-180.
- Properties of solders used in vacuum technology; microscopic investigation of their structure in the cast state. Micrographs, graphs, tables. (K7, SG-f, Ag, Cu)
- 218-K. The Athyweld Process. Edgar Allen News, v. 34, May 1955, p. 97-101.
- Method of atomic hydrogen welding of toolsteel which permits close carbon control. Diagrams, photograph. (K1, TS)
- 219-K. Welding Methods and Acid Resisting Alloys Used in Germany. (Review of "Recent Welding Developments in Apparatus and Tank Construction", by H. Engstler; "The Acid Resistance of Low-Nickel, High-Chromium Alloys With Molybdenum and Copper Additions", by W. Tofaute and H. J. Rocha; "Welding in Modern Shipbuilding", by K. Holand; "Technische Mitteilungen Krupp", v. 3, June 1954.) *Metal Progress*, v. 67, June 1955, p. 194, 196, 198.
- Review of progress in welding; covers submerged-arc welding practices and the economies that can be obtained from the higher metal deposition this process offers over manual welding with covered electrodes. (K1, SS)
- 220-K. Latest in Butt-Welding. Long Rails by Flash Process. *Railway Age*, v. 138, June 6, 1955, p. 26-29.
- Technique developed in Europe for fabrication of continuous rail has been adapted for use here and is now producing welds on the Santa Fe. Photographs, diagram. (K3)
- 221-K. Tecumseh Uses Silver Alloy Brazing for Quality, Mass Production Joining. Victor Humble. *Refrigerating Engineering*, v. 63, May 1955, p. 46-49, 121.
- The range, variety and adaptability of the process. Photographs. (K8, Ag)
- 222-K. Spot Welding of High-Tensile Steels. P. Jourmat. *Sheet Metal Industries*, v. 32, no. 337, May 1955, p. 357-360.
- Method for determining settings of resistance welding machines. Diagrams, photographs. 2 ref. (K3, AY)
- 223-K. An Examination of Fusion Welding Processes Suitable for Vitreous Enamelling. B. Trehearne. *Sheet Metal Industries*, v. 32, no. 337, May 1955, p. 361-362.
- Methods of welding examined were metallic arc, argon arc, oxy-acetylene and atomic hydrogen. Table. 2 ref. (K1, K2, L27)
- 224-K. High-Strength, Butt-Brazed Joints. Orville T. Barnett and Niko-

- lajs Bredzs. *Steel*, v. 136, May 23, 1955, p. 114, 117.
- Technique gives pure silver filler metal a tensile strength of 84,000 psi. before failing. Photograph, graph. (K8, Q23)
- 225-K.** Resistance Welding May be the Answer. Thomas F. Hruby. *Steel*, v. 136, May 30, 1955, p. 70-72.
- Advantages and applications of spot, projection, flash and seam welding. Photographs. (K3)
- 226-K.** New Record for All-Welded Construction. W. L. Doherty. *Steel*, v. 136, May 30, 1955, p. 74-75.
- Applications, advantages, and methods of hidden-arc welding in fabrication of buildings, bridges and other structures. Photographs. (K1, T25)
- 227-K.** Tig Welding With a CO₂ Shield. Edward J. Vogel and D. F. Zimmerman. *Welding Engineer*, v. 40, June 1955, p. 28-29, 62.
- Report on tests wherein CO₂ was used as an additional shielding medium in the tungsten-inert gas method. Diagram, photograph, table. (K1)
- 228-K.** Filler Metals for Joining. Orville T. Barnett. *Welding Engineer*, v. 40, June 1955, p. 30-32.
- Discussion of the E6010 electrode group. Photograph, diagrams, tables. 2 ref. (K1)
- 229-K.** Welding Brass Strip. Arthur I. Heim. *Welding Engineer*, v. 40, June 1955, p. 34-37.
- Progress report on procedures used commercially. (K general, Cu)
- 230-K.** Resistance Welding for the Wire Worker. III. R. H. Jordan. *Wire Industry*, v. 22, May 1955, p. 489-490, 492.
- Some aspects of resistance welding as used in wire goods production. Photographs. (K3)
- 231-K.** (French.) Welding of Clad Steels. L. F. Denaro and J. Hinde. *Soudage et Techniques connexes*, v. 9, nos. 3-4, Mar.-Apr. 1955, p. 63-76; disc., p. 76-80.
- Methods adaptable for nickel, monel, inconel, austenitic and chromium clad steels. Heat treatment precautions. Tables, diagrams, schematic drawings, photographs. 16 ref. (K general, J general, L22, ST)
- 232-K.** (French.) Construction of Welded Condensers and Exchangers. R. Piéplu. *Soudage et Techniques connexes*, v. 9, nos. 3-4, Mar.-Apr. 1955, p. 91-96.
- Materials, method of welding, and examples. Tables, photographs. (K general)
- 233-K.** (French.) Spot Welding of High-Strength Steel. P. Joumat. *Soudage et Techniques connexes*, v. 9, nos. 3-4, Mar.-Apr. 1955, p. 97-100.
- Method for determining the regulation of resistance welding machines. Drawing, photographs, charts. (K3, AY-N)
- 234-K.** (Russian.) Increasing the Strength of Welded Cylindrical Reservoirs. A. S. Falkovich. *Neftegaz Khozstvo*, v. 3, no. 5, May 1955, p. 69-77.
- Types of cracking and failures; types of welding recommended for new and in-service tanks. Diagrams, graph, photograph, table. (K general, Q23)
- 235-K.** (Russian.) Investigation of the Contact Butt-Welding of Cast Iron. I. R. Patskevich and V. M. Shakhmatov. *Svarochnoe Proizvodstvo*, 1955, no. 5, May, p. 1-4.
- Flash welding, with and without preheating, according to several procedures. Microstructure (martensitic-austenitic, pearlitic, etc.) in and beyond weld area; inclusions. Mechanical properties. Tables, micrographs, graph. (K1, M27, Q general, CI)
- 236-K.** (Russian.) Shielded Metal-Arc One-Pass Welding of Longitudinal and Circular Seams of Boiler Drums. I. D. Davydenko. *Svarochnoe Proizvodstvo*, 1955, no. 5, May, p. 11-13.
- Techniques. Type of current, thickness of electrode wire and amount melted, strength of welding current. Flux fosters formation of protective slag covering. Diagrams, table. (K1, ST)
- 237-K.** (Russian.) Welded-Cast Assemblies of a Steam Turbine. S. I. German. *Svarochnoe Proizvodstvo*, 1955, no. 5, May, p. 14-16.
- Welding techniques for the correction of casting defects in thick-walls of cast parts of complex configuration. Conditions of heat treatment during welding. Fluxes used. Mechanical properties and microstructures. Graphs, micrographs, photographs, table. (K general, J general, M27, Q general, ST, AY)
- 238-K.** (Russian.) Use of Welding to Repair the Cylinders of Powerful Hydraulic Presses. K. P. Voshchanov. *Svarochnoe Proizvodstvo*, 1955, no. 5, May, p. 16-20.
- Techniques for repair of casting defects and cracks developed in service. Equipment for preheating and building up of deposits. Diameter of electrode and current strength prescribed for the several layers to be welded. Diagrams, tables, graph, photograph. (K1, CN)
- 239-K.** (Russian.) Problem of the Depth of Weld Penetration in Manual Welding. A. S. Chesnokov. *Svarochnoe Proizvodstvo*, 1955, no. 5, May, p. 24-27.
- Calculation of factors in electric arc welding including electrode diameters, current strength, seam parameters. Problem of T-shaped welds. Composition of weld. Mechanical properties. Graphs, tables, diagrams. (K1, Q general, ST)
- 240-K.** (Spanish.) Cast Iron and Its Welding. Salvador M. Checa Casajus. *Ciencia y técnica de la Soldadura*, v. 5, no. 22, Feb. 1955, 14 p.
- Physico-chemical aspect of the fusion; influence of certain chemical elements; types of welding and optimum conditions. Graphs, tables, diagrams. (K general, CI)
- 241-K.** (Spanish.) Flash Welding. Evert H. Bylin. *Ciencia y técnica de la Soldadura*, v. 5, no. 22, Feb. 1955, 13 p.
- Influence of different factors on the quality of the welding joint; fields of application. Diagrams, graphs. (K3)
- 242-K.** (Spanish.) Welding With Austenitic Alloyed Steel Electrodes. M. de Miro and J. L. Zuloaga. *Ciencia y técnica de la Soldadura*, v. 5, no. 22, Feb. 1955, 9 p.
- Mechanical properties of welded seams; composition of the electrodes. Tables, micrographs, diagrams. (K1, AY)
- 243-L.** Cystine as an Addition Agent in the Electrodeposition of Copper. A. J. Sukava and C. A. Winkler. *Canadian Journal of Chemistry*, v. 33, May 1955, p. 961-970.
- Cystine gave polarization-time curves similar to those of gelatine. Graphs. 13 ref. (L17, Cu)
- 372-L.** Stop Corrosion From Sulfur Compounds, Hydrochloric Acid. H. E. Smith and Gordon Weyermuller. *Chemical Processing*, v. 18, May 1955, p. 22-24.
- How 410 stainless cladding solved problems at Humble Oil & Refining Co. pipe still. Photograph. (L22, SS)
- 373-L.** Guards Against Corrosive Iodine Fumes. Edgar B. Witmer and Roy Helsing. *Chemical Processing*, v. 18, May 1955, p. 76-77.
- Controlled with a chlorinated rubber-base enamel. Photograph. (L26)
- 374-L.** Electroplating on Aluminum. R. F. Hafer. *Metal Progress*, v. 67, May 1955, p. 93-97.
- Careful surface preparation is needed to obtain sound and adherent electrodeposits. Photographs, table. (L17, Al)
- 375-L.** Tin Plating of Copper Wire. C. Fred Gurnham. *Products Finishing*, v. 19, May 1955, p. 56 + 5 pages.
- Stannous fluoborate plating has many advantages over hot-dip process. Photograph. (L16, Cu, Sn)
- 376-L.** (Dutch.) Currentless Nickel Plating. A. Liket. *Bedrijf en Techniek*, v. 10, no. 225, Apr. 9, 1955, p. 162-164.
- Principle; composition and control of nickel-plating bath; properties of nickel deposits. Diagrams, table. 24 ref. (L14, Ni)
- 377-L.** (German.) Adherence of Iron-Saturated Zinc Melt to Manganese-Containing Iron. Hans-Joachim Wiesner and Dietrich Horstmann. *Archiv für das Eisenhüttenwesen*, v. 26, no. 4, Apr. 1955, p. 199-204.
- Influence of temperature and time on adherence of zinc to iron containing up to 9.3% manganese. Tables, graphs, micrographs. 4 ref. (L16, Zn)
- 378-L.** (German.) Mechanism of Corrosion of Plain and Painted Iron Objects. A. Bukowiecki. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 21, no. 4, Apr. 1955, p. 121-133.
- Corrosive action of water and atmosphere; paint as a protective agent and its effectiveness on corroded surfaces; corrosion mechanism under paint. Tables, drawings, diagrams. 62 ref. (L26, R4, R3, Fe)
- 379-L.** (Norwegian.) Nickel Plating. Frithjof Dynvold. *Teknisk Ukeblad*, v. 102, no. 15, Apr. 14, 1955, p. 303-307.
- Development and principles of electrolytic and chemical nickel plating; bath compositions; mechanical properties of the deposits. 7 ref. (L17, L14, Q general, Ni)
- 380-L.** Paint Faults and Remedies. X. H. Courtney Bryson. *Corrosion Prevention and Control*, v. 2, May 1955, p. 29-32.
- Causes of discoloration and their control. Photograph. (To be continued.) (L26)
- 381-L.** Rubber and Allied Substances as Anti-Corrosive Materials. B. J. Wilson. *Corrosion Technology*, v. 2, Apr. 1955, p. 107-112.
- Natural rubber; synthetic rubber; and rubber-like plastics including PVC, polyethylene, Saran, Teflon and Kel-F. Photographs, table. 11 ref. (L26)
- 382-L.** The Coating of Magnesium Alloys. W. E. Allesbrook. *Corrosion Technology*, v. 2, Apr. 1955, p. 113-116.

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- Methods of treatment and painting used to preserve magnesium alloys, extensively used in castings where lightness is essential. Photographs. 9 ref. (L26, Mg)
- 383-L. Economy in Manual Spray Gun Operation.** J. Muirhead. *Electroplating and Metal Finishing*, v. 8, May 1955, p. 172-176.
- Factors which influence cost and quality in manual spray painting include correct choice of spraying equipment and materials, training of spraying operator and proper supervision and process control. Photographs. (L26)
- 384-L. Metal Spraying for Protection of Iron and Steel.** *Electroplating and Metal Finishing*, v. 8, May 1955, p. 177-180.
- Summary of new British and U. S. specifications for spraying for atmospheric and high-temperature protection. Tables. 4 ref. (L23, S22, ST)
- 385-L. The Protection of Iron and Steel by Sprayed Coatings of Aluminum or Zinc.** F. A. Champion. *Electroplating and Metal Finishing*, v. 8, May 1955, p. 180-182, 189.
- Effects of coating weight and thickness on life of steel exposed to atmospheric corrosion. Graphs, table. 12 ref. (L23, R3, Al, Zn)
- 386-L. Automation in the Plating Industry.** H. Silman. *Electroplating and Metal Finishing*, v. 8, May 1955, p. 184-189.
- Principles of mechanization in electroplating; compares through-type and return-type machines; instrumentation and automatic control systems. Photographs, diagrams. 12 ref. (L17)
- 387-L. Electroplating of Precious Metals.** S. W. Baier. *Industrial Finishing (London)*, v. 8, Apr. 1955, p. 203-209.
- Processes in use today for electroplating silver, gold, rhodium, palladium and platinum and recent modifications. Tables, photographs. 16 ref. (L17, Ag, Au, Rh, Pd, Pt)
- 388-L. Metallic Coatings on Non-Metallic Surfaces. II. Lead Sulphide Films. III. Nickel Films.** *Industrial Finishing (London)*, v. 8, Apr. 1955, p. 214, 216-218.
- Formulations, properties and applications. (L general, Ni)
- 389-L. Modern Porcelain Enameling System for Stove Parts Utilizes Gas Furnaces and Ovens.** *Industrial Heating*, v. 22, Apr. 1955, p. 799 + 6 pages.
- Surface preparation; ground and cover coats; laboratory control. Photographs. (L27)
- 390-L. Russian Work on Sulphided Steels.** W. G. Cass. *Iron & Steel*, v. 23, May 1955, p. 204, 263, 288.
- Results of tests reported in Soviet publications. Table. (L15, ST)
- 391-L. Electroless Nickel Plating.** J. L. Chinna. *Materials & Methods*, v. 41, May 1955, p. 104-106.
- Advantages and applications, plate properties. Photographs, micrograph. (L14, Ni)
- 392-L. Standardization of Chromium Bath Tests on a Bent Cathode in the Hull Cell. I. Development and Standardization of a Method to Evaluate Covering Power.** Robert H. Rousselot. *Metal Finishing*, v. 53, May 1955, p. 50-53, 55.
- Standardization of test is limited to establishing the angle of bend, the fillet radius of the apex, total current and duration and quantitative determination of covering power. Diagrams, graphs, table. (To be continued.) (L17, Cr)
- 393-L. Spotting-Out and Staining on Plated Work.** G. B. Hogaboam, Jr. *Metal Finishing*, v. 53, May 1955, p. 54-55.
- Causes of spotting that originate in the preparation of an article before plating. Photograph. (L17)
- 394-L. Complex Ions in Chromium Plating Solutions.** Gunnar Gabrielsson. *Metal Finishing*, v. 53, May 1955, p. 56-58.
- Use of ion exchangers in the analysis of chromium plating baths to remove interfering ions. Tables. 23 ref. (L17, Cr)
- 395-L. Plating Bath Control: Past, Present and Future.** Joseph E. Kushner. *Metal Finishing*, v. 53, May 1955, p. 59-63.
- Control of temperature, agitation, time, electrical energy and composition in plating baths. Diagrams. (L17)
- 396-L. Electropolishing "Nimonic 80".** K. F. Lorking. *Metal Finishing*, v. 53, May 1955, p. 64-66.
- Conditions of optimum electrolyte composition, current density, cell voltage and temperature have been established. Micrograph, graphs, table. 6 ref. (L13, Ni)
- 397-L. Modern Electroplating Plant.** W. H. Simons. *Metal Industry*, v. 86, Apr. 29, 1955, p. 333-338.
- Indications of the trend of progress in the metal finishing field. Photographs. (L17)
- 398-L. Red Lead Paints for Galvanized Surfaces.** Charles E. Cherry, Jr. *Paint and Varnish Production*, v. 45, May 1955, p. 23-26.
- Five formulations and test results from their use. Photographs. (L16, L26)
- 399-L. Introductory Plating Studies on Protecting Molybdenum From High-Temperature Oxidation.** L. E. Vaaler, C. A. Snavely, and C. L. Faust. *U. S. Atomic Energy Commission, BMI-813*, 1953, 20 p.
- Electrodeposited nickel protected molybdenum from air oxidation for 100 hr. at 1800° F. Nickel was deposited on molybdenum after various pretreatments: a.c. electrolysis in hydrofluoric acid; a dip in alkaline ferricyanide solution; or a combination of anodic cleaning in alkali, a dip in nitric acid and in alkaline ferricyanide. In most cases, a thin layer of chromium or iron was deposited prior to nickel deposition. All deposits blistered when heated to 800° F. in a vacuum (100 μ) except when iron was deposited prior to the nickel. Attempts were unsuccessful to deposit copper which would not blister on molybdenum when heated. Micrographs, tables. 7 ref. (L17, Ni, Mo, Cu)
- 400-L. (German.) Pickling and Etching Aluminum.** A. Blankbeizen. *Aluminium Ranshofen, Mitteilungen*, v. 3, no. 1, Feb. 1955, p. 3-4.
- Procedures, bath compositions, temperatures and times of pickling and etching aluminum and its alloys. (L12, Al)
- 401-L. (German.) Treatment and Corrosion Protection of Surfaces by Means of High Vacuum Vapor Metallization.** Walter Reichelt. *Zeitschrift für Metallkunde*, v. 46, no. 4, Apr. 1955, p. 268-271.
- Characteristics and techniques of the process; evaporation and condensation in high vacuum; fields of application. Photographs. 2 ref. (L25)
- 402-L. Preparation of Metals for Painting.** R. E. Shaw. *Corrosion Technology*, v. 2, May 1955, p. 136-142.
- Surveys present-day techniques; includes sections on testing, economics and design considerations. Photographs, table, diagram. (L10, L12, L26)
- 403-L. The Prevention of Corrosion.** Institute of Marine Engineers. *Transactions*, v. 67, Apr. 1955, p. 132-138.
- Corrosion in air, soil and water. Protection by means of coatings. Graphs, photographs. 14 ref. (L general, R general)
- 404-L. Anodized Coatings: What They Are—How They Behave.** I. C. C. Cohn. *Iron Age*, v. 175, May 26, 1955, p. 91-94.
- Film which improves aluminum surfaces as to corrosion protection, insulation value, rectifier effect, colorability, paint-base, abrasion resistance, electroplating base, printing base and other properties. Diagram, photographs. (To be continued.) (L19, Al)
- 405-L. Here's How Vinyl-To-Metal Laminates Are Made and Used.** *Modern Plastics*, v. 32, June 1955, p. 107-111, 230.
- Light-weight luggage, fabricated of vinyl-to-magnesium laminate, is durable and scuff resistant. Photographs. (L22, Mg)
- 406-L. The Anti-Corrosive Value of Paints.** F. Fancutt. *Paint Manufacture*, v. 25, May 1955, p. 189-194.
- An international symposium of seven papers presented by the Corrosion Group of the Society of Chemical Industry. Covers priming, principles and painting practice on steel, testing and influence of constituents and formulation. (L26)
- 407-L. Chromium Plating of Engine Cylinders Can Slash Wear Rates, Up Economy.** Russell Pyles. *Power*, v. 99, June 1955, p. 132-133.
- Porous chromium is produced by electrolytic or chemical action on chromium plate on a smooth honed bore. Photograph, micrographs. (L17, Cr)
- 408-L. Surface Treatment and Finishing of Light Metals. XI.** S. Wernick and R. Pinner. *Sheet Metal Industries*, v. 32, no. 337, May 1955, p. 345-356, 372.
- Production, cooling, properties, adhesion, corrosion resistance and applications. Graphs, diagrams, micrographs, tables. 17 ref. (L19)
- 409-L. Modern Developments in Paint Processes.** R. L. Yeates. *Sheet Metal Industries*, v. 32, no. 337, May 1955, p. 369-372.
- Present trend of paint finishing is towards the use of synthetic materials and also towards the use of stoving schedules. (L26)
- 410-L. Phosphate Coatings for Facilitating Cold-Working.** W. Rausch and H. Fleischhauer. (Translated from the German by Jerome W. Howe.) *Wire and Wire Products*, v. 30, May 1955, p. 552, 559-603.
- This process creates a firm intergrowth of the coating with the material. Phosphate solutions are commonly aqueous solutions which contain a film-forming metal, preferably zinc and phosphoric acid. (L14, G21)
- 411-L. Hot Dip Galvanizing Is a Science. IV.** Wallace G. Imhoff. *Wire and Wire Products*, v. 30 May 1955, p. 553-556, 605.
- The longer the pickling time, the more zinc is deposited as galvanized coating. Tables, photographs, graphs. (L16)
- 412-L. (German.) Possible Applications of Resin-Emulsion Paints.** B. Schmücker. *Fette, Seifen, Anstrichmittel*, v. 57, no. 5, May 1955, p. 333-340.

- Practical results of application for special purposes such as rust-proof coatings. Photographs, micrographs. (L26)
- 413-L.** (German.) Electrolytic Deposition of Lead-Tin Alloy. Ernst Raub and Walter Blum. *Metalloberfläche*, v. 9, no. 4, Apr. 1955, p. 54A-57A.
- Relation of plating conditions, bath composition and temperature to composition of the deposits. Tables, graphs. 7 ref. (L17, Pb, Sn)
- 414-L.** (Russian.) Automatic Application of Weld-Deposited Coating on Blooming Rolls. K. V. Bagrianskii, I. M. Kramchaninov, D. S. Kassov and V. T. Sopin. *Svarochnoe Proizvodstvo*, 1955, no. 5, May, p. 20-23.
- Composition of welding mixture. Welding machine used. Corrosion, fracture and wear-resistance of weld-coated areas of roll. Photographs, diagrams, table, micrograph. 9 ref. (L24, ST)
- 415-L.** (Russian.) Problem of Obtaining High-Quality Galvanic Coatings on Parts Made of Zinc Alloys. G. S. Vozdvizhenskii, V. A. Dmitriev, A. G. Mozhanova, E. V. Rzhevskaya and D. E. Chasov. *Zhurnal Prikladnoi Khimii*, v. 28, no. 5, May 1955, p. 484-489.
- Effect on coatings of pores and slag inclusions in the castings. Proper cyanide content, temperature and pH for copper plating. Photographs, tables. 6 ref. (L16, Zn, Cu)
- 416-L.** (Book.) Aluminum Paint and Powder. Junius David Edwards and Robert I. Wray. 3rd Ed. 219 p. 1955. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.
- Manufacture; properties; testing; applications. (L26, H10, Al)
- 417-L.** (Book.) Protective Coatings for Metals. R. M. Burns and W. W. Bradley. American Chemical Society Monograph Series No. 129. 2nd Ed. 643 p. 1955. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. \$7.50.
- Surface preparation; metallic and nonmetallic coating types; application methods and use. (L general)
- 168-M.** Metallographic Polishing of Cast Iron. L. E. Samuels. *Iron and Steel Institute, Journal*, v. 180, May 1955, p. 23-25 + 2 plates.
- Modification of a general method of metallographic polishing based on the use of diamond abrasives. Micrographs. 8 ref. (M21, CI)
- 169-M.** A High-Resolution Metallograph for Elevated Temperatures. J. E. Jenkins, D. R. Buchele and R. A. Long. *Metal Progress*, v. 67, May 1955, p. 101-104.
- Microscope hot stage and special objective of reflecting elements with a long working distance and a high numerical aperture to give maximum resolving power. Changes in microstructure photographed with movie camera. Photograph, diagrams, micrographs. (M21)
- 170-M.** A Microscope Hot Stage. H. A. Saller, R. F. Dickerson and R. J. Carlson. *Metal Progress*, v. 67, May 1955, p. 105-108.
- Compact unit for studying structural changes in metals at temperatures up to 1800° F. Covers vacuum furnace, optical group, cold trap and vacuum system. Diagram, photograph, micrographs. (M21)
- 171-M.** Structure of the ω -Precipitate in Titanium-16 Per Cent Vanadium Alloy. J. M. Silcock, M. H. Davies and H. K. Hardy. *Nature*, v. 175, Apr. 23, 1955, p. 731.
- Relation between beta and omega titanium as shown by study in molybdenum K-alpha radiation. X-ray diffractogram, diagram. 4 ref. (M26, Ti, V)
- 172-M.** (French.) Anodic Attack, Especially Suited to the Electron Micrography of 80-20 Nickel-Chromium-Type Alloys Susceptible to Hot Tough Structural Hardening. Yves Baillie and Pierre Gilles. *Comptes rendus*, v. 240, no. 13, Mar. 28, 1955, p. 1430-1432.
- Metallographic preparation of Nimonic alloys is improved by using an anodic attack with hydrofluoric acid. Micrographs. 5 ref. (M21, Ni, Cr)
- 173-M.** (Russian.) X-Ray Investigation of Initial Stages of the Breakdown of a Supersaturated Solution of a Delta Solid Solution of Silver-Aluminum. A. M. Elistratov. *Doklady Akademii Nauk SSSR*, v. 101, no. 3, Mar. 21, 1955, p. 473-476 + 1 plate.
- Experimental data about structural changes in crystals of a supersaturated solid solution of silver in aluminum (delta-phase); three stages involved; gamma-phase. Diffraction patterns. 10 ref. (M26, Ag, Al)
- 174-M.** (Russian.) Problem of Mosaic Texture in Semicrystalline Metals. V. I. Iveronova and A. A. Katsnel'son. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 696-699.
- Studies on iron-palladium and iron-cobalt alloys at various temperatures and durations of tempering. Graphs. 6 ref. (M26, Fe, Pd, Co)
- 175-M.** The Compound Na₂Pb₃. Ivar T. Krohn, R. C. Werner and Hymin Shapiro. *American Chemical Society, Journal*, v. 77, Apr. 20, 1955, p. 2110-2113.
- Sodium-lead equilibrium diagram restudied by thermal and microscopic analysis. Table, phase diagram. 14 ref. (M24, Na, Pb)
- 176-M.** Quantitative Use of X-Ray Diffraction for Analysis of Iron Oxides in Gogebic Taconite of Wisconsin. R. S. Shoemaker and D. L. Harris. *Mining Engineering*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 202, May 1955, p. 476-480.
- X-ray diffraction procedures; applications to beneficiation studies. Diagram, tables, graphs. 13 ref. (M22, B14, Fe)
- 177-M.** The System Niobium-Silicon and the Effect of Carbon on the Structures of Certain Silicides. A. G. Knaption. *Nature*, v. 175, Apr. 23, 1955, p. 730.
- Phase diagram of the niobium-silicon system determined by melting-point determinations. X-ray examination and metallography. (M24, Nb, Si)
- 178-M.** (German.) Manganese Alloys With Platinum, Iridium, Rhodium, and Ruthenium. Ernst Raub and Werner Mahler. *Zeitschrift für Metallkunde*, v. 46, no. 4, Apr. 1955, p. 282-290.
- X-ray and metallographic investigations of binary systems. Constitution diagrams, tables, micrographs. 18 ref. (M24, Mn)
- 179-M.** (German.) Constitution of the Binary Systems: Gallium-Antimony, Gallium-Arsenic, and Aluminum-Arsenic. Werner Köster and Berthold Thoma. *Zeitschrift für Metallkunde*, v. 46, no. 4, Apr. 1955, p. 291-293.
- Analysis of constitution diagrams. Graphs, micrographs. 7 ref. (M24, Ga, Sb, Al, As)
- 180-M.** (German.) Constitution of the Ternary System of the Metals of the Third and Fifth Groups of the Periodic System. Werner Köster and Berthold Thoma. *Zeitschrift für Metallkunde*, v. 46, no. 4, Apr. 1955, p. 293-297.
- Constitutional diagrams of the systems: aluminum-gallium-antimony, aluminum-indium-antimony, and gallium-indium-antimony. Micrographic study of the systems. Diagrams, micrographs, graphs. 7 ref. (M24, Al, Ga, In, Sb)
- 181-M.** (Hungarian.) Preparation of Cast Iron for Microscopic Investigation. Ferenc Boda. *Ontode*, v. 6, no. 4, Apr. 1955, p. 91-96.
- Review of various processes; methods for decreasing time for specimen preparation; author's rapid polishing process. Micrographs. 9 ref. (M21, CI)
- 182-M.** (Russian.) Mechanism of the Effect of Alternating Current on the Structure of Copper Deposits. K. M. Gorbulina and A. A. Sutiagina. *Zhurnal Fizicheskoi Khimii*, v. 29, no. 3, Mar. 1955, p. 542-546.
- Depending on amplitude, application of alternating current causes a smoothing of the surface of the deposit and the formation of friable, flocculent fine-crystal deposits. Oscilograms, micrographs. 9 ref. (M26, Cu)
- 183-M.** An X-Ray Study of the System Uranium Monocarbide-Uranium Dicarbide-Beryllium Carbide. M. D. Burdick, H. S. Parker, R. S. Roth and E. L. McGandy. *Journal of Research, National Bureau of Standards*, v. 54, Apr. 1955, p. 217-229.
- X-ray diffraction methods applied to study of system heated to 1700° C. and quenched. Room-temperature stability of uranium sesquicarbide is verified. Tables, graphs, diagram, phase diagrams. 21 ref. (M24, M22, Be, U)
- 184-M.** Factors Affecting Micro-character of Metal Surfaces. (Digest of "Changes in Metallic Surfaces Produced by Chemical Processes and by Heating", by S. Z. Roginskii, I. I. Tret'yakov and A. B. Shekhter; *Doklady Akademii Nauk SSSR*, v. 91, 1953, p. 1167-1169.) *Metal Progress*, v. 67, June 1955, p. 202, 204, 206.
- Previously abstracted from original. See item 41-M, 1954. (M21)
- 185-M.** Brillouin Zones of Some Intermetallic Compounds. P. J. Black. *Philosophical Magazine*, v. 46, 7th ser., no. 375, Apr. 1955, p. 401-409.
- Data for nine aluminum-rich compounds of iron obtained by X-ray analysis. Tables. 23 ref. (M22, Al)
- 186-M.** A New Treatment of Anharmonicity in Lattice Thermodynamics. I-II. D. J. Hooton. *Philosophical Magazine*, v. 46, 7th ser., no. 375, Apr. 1955, p. 422-442.
- Approximate solution of anharmonic vibrational motion of atoms in crystal. 7 ref. (M25)
- 187-M.** Interaction of Dislocations and F-Centres in Sodium Chloride Single Crystals. S. Amelinckx, W. Van der Vorst, R. Gevers and W. Dekeyser. *Philosophical Magazine*, v. 46, 7th ser., no. 375 Apr. 1955, p. 450-451 + 1 plate.
- Studies indicate that dislocation networks may act as precipitation zones. Photographs. 4 ref. (M26)
- 188-M.** (English.) Growth of Cadmium Iodide Crystals. John B. Newkirk. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 121-125 + 1 plate.

M

Metallography, Constitution and Primary Structures

168-M. Metallographic Polishing of Cast Iron. L. E. Samuels. *Iron and Steel Institute, Journal*, v. 180, May 1955, p. 23-25 + 2 plates.

Modification of a general method of metallographic polishing based on the use of diamond abrasives. Micrographs. 8 ref. (M21, CI)

169-M. A High-Resolution Metallograph for Elevated Temperatures. J. E. Jenkins, D. R. Buchele and R. A. Long. *Metal Progress*, v. 67, May 1955, p. 101-104.

Microscope hot stage and special objective of reflecting elements with a long working distance and a high numerical aperture to give maximum resolving power. Changes in microstructure photographed with movie camera. Photograph, diagrams, micrographs. (M21)

170-M. A Microscope Hot Stage. H. A. Saller, R. F. Dickerson and R. J. Carlson. *Metal Progress*, v. 67, May 1955, p. 105-108.

Compact unit for studying structural changes in metals at temperatures up to 1800° F. Covers vacuum furnace, optical group, cold trap and

Microscopic studies of step-by-step crystal formation and growth. Photographs, micrographs, diagrams, graph. 3 ref. (M26, N12, Cd)

189-M. (English.) The Segregation of Carbon in Iron Single Crystals as Studied by Torsion Pendulum Damping. F. W. Kunz. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 126-129.

Series of experiments on the effect of quenching and straining on the segregation of carbon in single crystals of alpha-iron. Graph. 8 ref. (M26, Fe)

190-M. (English.) Frictional Forces on Dislocation Arrays at the Lower Yield Point in Iron. A. Cracknell and N. J. Petch. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 186-189.

A linear relationship is calculated between sigma and the concentration of carbon + nitrogen in solution. This is confirmed by experimental measurements. Table, graphs. 16 ref. (M26, Fe)

191-M. (English.) X-Ray Line Broadening From Cold-Worked Iron. R. I. Garrod and J. H. Auld. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 190-198.

Measurements from cold-worked iron filings, and from wire specimens prestressed by uni-axial tension to various stages in the plastic range, analyzed in terms of both line breadths and line shapes for a number of high angle reflections. Diagram, tables, graphs. 28 ref. (M22, Fe)

192-M. (French.) Determination of Sub-Structures in Metal Single Crystals by Means of X-Rays. H. Lambot, L. Vassamillet and J. Dejace. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 150-156.

Method is capable of revealing essentially perfect sub-grains whose size is of the order of tens of microns and whose mutual disorientation is at least of the order of 1 min. of arc. Photographs. 28 ref. (M26, M22)

193-M. (French.) Indication of the Presence of Structural Imperfections in the "Sub-Grains" in Metal Crystals. Aurel Berghezan and Jean Héenguel. *Comptes rendus*, v. 240, no. 14, Apr. 4, 1955, p. 1536-1537.

Micrographic study of arrangement of the substructure of monocrystals of strongly cold worked aluminum with 3% magnesium in solid homogeneous solution and its evolution during annealing at low temperature. 3 ref. (M27, Al)

194-M. (Russian.) Effect of the Form of Pearlite and of Ferrite Grain Size on the Properties of Steel Castings. M. M. Kantor and N. M. Serpik. *Litinoe Proizvodstvo*, 1955, no. 5, May, p. 19-21.

Effect of various heat treatments on strength and structure. Micrographs, tables, graph. 2 ref. (M27, N8, Q general, CI)

195-M. (Book.) Electrons, Atoms, Metals and Alloys. William Hume-Rothery. Rev. Ed. 387 p. 1955. Philosophical Library, 15 East 40th Street, New York 16, N. Y. \$3.75.

Structure of atoms and nuclei; atomic structure of metals and alloys. Electronic basis of physical properties. (M25)

N

Transformations and Resulting Structures

216-N. The Strain-Ageing of Pure Iron. B. Jones and R. A. Owen-Barnett. *Iron and Steel Institute, Journal*, v. 180, May 1955, p. 20-23 + 2 plates.

Aging of pure iron after temper-rolling and tensile-straining. Tables, graphs, micrographs. 6 ref. (N7, Fe)

217-N. Kinetics of the Martensite Transformation in a Hyper-Eutectoid Steel. J. Philibert and C. Crussard. *Iron and Steel Institute, Journal*, v. 180, May 1955, p. 39-48 + 1 plate; disc., p. 48-50.

Study of nucleation of martensite and theoretical calculations to account for high rate of nucleation. Graphs, micrographs. 12 ref. (N8, AY)

218-N. (French.) Ordered Phase of a Copper Alloy Having 2% Beryllium. Arunachala Viswanathan. *Comptes rendus*, v. 240, no. 13, Mar. 28, 1955, p. 1428-1430.

Copper alloy shows, by quenching from 750° C., the appearance of a tetragonal gamma phase which is transformed into the gamma phase upon tempering. Diagram. 2 ref. (N10, Cu)

219-N. (German.) Contribution to the Investigation of Recrystallization Processes. Z. Morlin. *Acta Physica Academiae Scientiarum Hungaricae*, v. 4, no. 3, 1955, p. 197-208.

Microscopic study of recrystallization mechanism and grain boundaries in sodium chloride. Micrographs. 7 ref. (N5)

220-N. (Russian.) Theory of Diffusion of Atoms in Alloys. M. A. Krivoglaz and A. A. Smirnov. *Uspekhi Fizicheskikh Nauk*, v. 60, no. 3, Mar. 1955, p. 391-442.

Diffusion effected by vacancy mechanism interstitially in crystal lattice; equations for determining diffusion coefficient in alloys of beta brass, Fe-Al, etc. Diagrams, graphs. 29 ref. (N1, Cu, Fe, Al)

221-N. (Russian.) Investigation of the Martensitic Transformation in Steel. A. N. Alfimov and A. P. Guliaev. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 680-686.

Temperature and kinetics of transformation during cooling. Effect of grain size and number of grains in test piece on start of transformation. Graphs, photographs, micrograph. 4 ref. (N8, ST)

222-N. (Russian.) Diffusion of Tin and Antimony in Semiconductor Compounds of Bi₂Se₃ and Bi₂Te₃. B. Bol'taks. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 767-768.

Measurement of coefficients of diffusion, in various temperature ranges, by radioactive isotopes and the absorption method. Graphs. 4 ref. (N1, Se, Te, Bi)

223-N. Effect of Plastic Deformation on the Kinetics of Martensite Formation in a High Chromium Steel. S. C. Das Gupta and S. S. Pani. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 161-169; disc., p. 169-171.

Effect of varying degrees of deformation produced by compression and tension on the austenite-martensite transformation in a 15% chromium-0.7% carbon steel. Graphs. 23 ref. (N8, Q24, AY)

224-N. Mechanism of a New Type of Ageing Phenomenon in Iron and Steel on Anodic Surcharging. K. C. Som and G. P. Chatterjee. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 196-208; disc., p. 208-210.

Various phenomena responsible for changes in hardness. Graphs, tables. 8 ref. (N7, Fe, ST)

225-N. Diffusion in Solid Metals and Alloys. G. P. Chatterjee. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 223-229; disc., p. 229-231.

Development of the concept of diffusion on the basis of potential and energy-density considerations. 10 ref. (N1)

226-N. Diffusion of Zinc in Alpha Brass Containing Tin. K. C. Som, P. K. Sen and G. P. Chatterjee. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 233-238; disc., p. 239-240.

Diffusion was evaluated as function of concentration and temperature. Diffusion coefficient of zinc is increased by the presence of tin. Diagram, tables, graphs. 6 ref. (N1, Cu, Zn, Sn)

227-N. Electrolytic Migration of Carbon in Steel. P. Dayal and L. S. Darken. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 241-250.

Accurate determination of the migration rate under the influence of direct current and the varying conditions of temperature and concentration, the charge borne by the carbon ion in austenite, and the transport number of carbon. Diagrams, table, micrographs. 9 ref. (N1, ST)

228-N. Anisotropic Diffusion Lengths in Diffusion Theory. Bernard I. Spinrad. *Journal of Applied Physics*, v. 26, May 1955, p. 548-550.

A set of formulas defining diffusion lengths in heterogeneous assemblies which, even in the homogeneous limit, lead to anisotropic diffusion lengths for systems such as rod or slab assemblies which are microscopically anisotropic. (N1)

229-N. Nucleation of Ammonium Iodide Crystals From Aqueous Solutions. J. B. Newkirk and D. Turnbull. *Journal of Applied Physics*, v. 26, May 1955, p. 579-583.

Attempts to find a quantitative relationship between the kinetics of nucleation and the atomic disregistry on the unstrained conjugate planes of the catalyst and nucleus. Graph, table, diagrams. 8 ref. (N2)

230-N. Allotropic Transformations in Ternary Metal Systems. A. Prince. *Metal Treatment and Drop Forging*, v. 22, May 1955, p. 198-201.

Transformation equilibria involving the melt. Diagrams. 5 ref. (N6)

231-N. Growth of Monocrystals of Germanium From an Undercooled Melt. E. Billig. *Royal Society, Proceedings*, v. 229, ser. A, May 10, 1955, p. 346-363 + 5 plates.

Technique developed for rapid growth of monocrystals of germanium and other materials with the diamond or zinc blende structure. Tables, diagrams, micrographs, photographs. 14 ref. (N12, Ge)

232-N. (German.) Radiation Damage and Diffusion Processes in Precious Metals. A. Seeger. *Zeitschrift für Naturforschung*, v. 10a, no. 3, Mar. 1955, p. 251-253.

Effect of bombardment with deuteron particles, plastic deformation and quenching on the lattice structures of copper, silver, gold, and their alloys. Tables. 12 ref. (N1, Cu, Ag, Au)

233-N. (Russian.) Quantitative Investigation of the Distribution of Ele-

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ments in Alloys. S. T. Kishkin, S. Z. Bokshstein, L. M. Moroz and T. I. Gudikova. *Doklady Akademii Nauk SSSR*, v. 101, no. 4, Apr. 1, 1955, p. 667-670.

Distribution of tungsten or of columbium in nickel; relation of micro-nhomogeneity to rate of crystallization, plastic deformation, heat treatment and alloy composition. Graphs, micrograph. 5 ref. (N12, Ni, Cb, W)

234-N. (Russian.) Kinetics of the Isothermal Martensite Transformation in the Vicinity of Absolute Zero. B. Ia. Liubov and Iu. A. Osip'yan. *Doklady Akademii Nauk SSSR*, v. 101, no. 5, Apr. 11, 1955, p. 853-856.

Effect of energy of atomic vibrations on process rate; classical and quantum effects at low temperatures. Table, graph. 7 ref. (N8)

235-N. (Russian.) Diagram of the Recrystallization of Iodide-Processed Titanium. E. M. Savitskii, M. A. Tylkina and A. N. Tirskaya. *Doklady Akademii Nauk SSSR*, v. 101, no. 5, Apr. 11, 1955, p. 857-859 + 1 plate.

Microstructures after cold rolling and tempering at various temperatures; optimum range for obtaining fine-grained recrystallization structure of alpha-modification. Phase diagram, micrographs. (N5, Th)

236-N. (Russian.) Intermediate Transformation of Supercooled Austenite. L. I. Kogan and R. I. Entin. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1955, no. 1, Jan., p. 67-79.

Redistribution of carbon during transformation of austenite at intermediate temperatures. Micrographs, graphs, tables. 22 ref. (N8, ST, AY)

237-N. The Influence of Lattice Vibrations on the Order-Disorder Transitions of Alloys. C. Booth and J. S. Rowlinson. *Faraday Society, Transactions*, v. 51, Apr. 1955, p. 463-467.

Statistical theory of order-disorder transitions modified to include the energy of the thermal vibrations of the atoms. Graph. 6 ref. (N10)

238-N. Recovery and Recrystallization in Metals Examined in Terms of the Restoration of the Transient Creep Properties. A. J. Kennedy. *Physical Society, Proceedings*, v. 68, no. 425B, May 1955, p. 257-276.

Investigation to determine the dependence of creep recovery on the temperature of the specimen during the recovery period. As recrystallization brings about a new mean grain size, the dependence of recovery on this factor is also examined. Graphs, table, diagrams. 34 ref. (N4, N5, Q3, Pb)

239-N. The Metallographic View. X. Effect of Heat Treatment on Medium Carbon Forgings. Howard E. Boyer. *Steel Processing*, v. 41, May 1955, p. 315-323.

In plain carbon steels, one heat treating operation is frequently sufficient to provide a structure suitable for machining, forming and final heat treatment; in the case of alloy steels, irrespective of carbon content, at least two heating operations are more often required before suitable structures can be obtained. Micrographs. (N8, J general, ST)

240-N. Solid Solutions and Grain Boundaries. B. L. Averbach, M. Cohen, F. Herbstein, J. Hilliard and R. Kaplow. *U. S. Atomic Energy Commission, NYO-7044*, Mar. 1955, 3 p.

Thermodynamic and X-ray techniques combined in a study of fundamental behavior of solid solutions. Solid solutions, adaptable to both of these methods, are being investigated in order that com-

bined data may be useful in providing a more complete picture of atomic configuration in solid solutions. (N12, M25)

241-N. Fundamentals of Cold Working and Recrystallization. B. L. Averbach, M. Cohen, S. Allen, M. F. Comerford and C. Houska. *U. S. Atomic Energy Commission, NYO-7044*, Mar. 31, 1955, 3 p.

Fourier analysis of X-ray diffraction line shapes and metallographic methods used to investigate detailed structure of plastically deformed metals. (N5, Q24)

242-N. Effect of Variations in Hardening and Tempering Temperatures. Edwin Gregory. *Wild-Barfield Heat-Treatment Journal*, v. 5, Mar. 1955, p. 2-4 + 3 plates.

Precipitation of chromium, molybdenum and vanadium carbides in steel and resultant shock and impact properties. Tables. (N7, Q6, J27, AY)

243-N. (English.) Grain Boundary Diffusion in a Body-Centered Cubic Lattice. C. W. Haynes and R. Smoluchowski. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 130-134.

Investigation of the possible variation of grain boundary diffusion where the orientation of the crystals formed the boundary. Table, graph, radiograph, diagrams. 20 ref. (N1, Fe)

244-N. (English.) On the Diffusion of Oxygen Through Solid Iron. J. L. Meijering. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 157-162.

Study of the existence of intergranular diffusion of oxygen though iron made in an argon atmosphere. Micrographs, graph. 27 ref. (N1, Fe)

245-N. (English.) Effect of Grain Boundaries Upon Formation and Dimensional Changes During Diffusion. R. W. Balluffi and L. L. Seigle. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 170-177.

Study of effect of grain-boundary configuration upon structural and shape changes in dezincified brass. Table, graphs, micrographs. 22 ref. (N1, Cu)

246-N. (English.) The Mechanisms of Self-Diffusion in Tin. J. F. Nicholas. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 178-181.

Experimental data for self-diffusion in tin analyzed in terms of six possible diffusion mechanisms. Tables, graph, diagram. 8 ref. (N1, Sn)

247-N. (Czech.) Diffusion Coefficient of Aluminum in Iron for Solid Solution Range. Pavel Gröbner. *Hutnické Listy*, v. 10, no. 4, Apr. 1955, p. 200-202.

Equation calculated for the diffusion coefficient of aluminum in iron for the temperature range 950 to 1100°C. Diagram, graphs, micrographs, tables. 9 ref. (N1, Fe, Al)

248-N. (Czech.) Phase Transformations in Copper-Aluminum and Copper-Aluminum-Nickel Alloys and Their Influence on Hardness. Karel Toman. *Hutnické Listy*, v. 10, no. 4, Apr. 1955, p. 202-209.

Phase relations and the structure of stable and meta-stable phases of the two systems. Graphs, diagrams, micrographs. 5 ref. (N6, Q29, Cu, Al, Ni)

249-N. (Polish.) Contemporary Views on the Dispersion Hardening of Metal Alloys. Fryderyk Staub and Kazimierz Joszt. *Hutnik*, v. 22, no. 2, Feb. 1955, p. 54-62.

Changes of strength properties during aging; statistical thermodynamic and precipitation hardening

theories; investigations utilizing irradiation by neutrons and electron microscopy. Graphs, table, diagrams. 28 ref. (N7, Q23)

250-N. (Russian.) Role of the Surface in the Graphitization of White Cast Iron. K. P. Bunin, Ia. V. Grechnyi, and N. M. Danil'chenko. *Litoeinoe Proizvodstvo*, 1955, no. 5, May, p. 12-15.

Diffusion of carbon in the austenite from one surface to another; effect of vacuum, hydrogen or inert gases on rate of graphitization; effects of variation of heat treatment and character of surface on rate of diffusion. Micrographs, diagrams. 26 ref. (N8, CI)

P

Physical Properties and Test Methods

253-P. Thermal Conductivity and Its Variability With Temperature and Pressure. Leon S. Kowalczyk. *American Society of Mechanical Engineers, Paper No. 54-A-90*, 1955, 33 p.

Present status of theory of thermal conductivity and attempts to explain its variability with temperature and pressure by means of the nature of heat, structure of matter and resistances offered by matter to heat conduction at various physical states. Tables, graphs. (P11)

254-P. Viscous Flow of Copper at High Temperatures. A. L. Pranatis and G. M. Pound. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, May 1955, p. 664-688.

Copper foils, of varying thickness and grain size, measured under such conditions of low stress and high temperature; it is believed that creep was predominately the result of interboundary diffusion. Tables, diagrams, graphs. 26 ref. (P10, N1, Q3, Cu)

255-P. Curie Temperatures of Binary and Ternary Sigma Phases. M. V. Nevitt and P. A. Beck. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, May 1955, p. 669-674.

Correlation of Curie temperature with composition may be described qualitatively in terms of contributions of the various component atomic moments to the saturation moment of the alloy. Tables, diagrams, graphs. 20 ref. (P16)

256-P. Radiolytic-Gas Bubbling Improves Convective Heat Transfer in Supro. Franklin P. Durham. *Nucleonics*, v. 13, May 1955, p. 42-46.

Experimental heat-transfer data and order-of-magnitude analyses of the effect on heat-transfer coefficient of fluid agitation caused by bubble evolution. Photograph, graphs, table. 8 ref. (P12)

257-P. Oscillatory Thermomagnetic Properties of a Bismuth Single Crystal at Liquid Helium Temperatures. M. C. Steele and J. Babiskin. *Physical Review*, v. 98, ser. 2, Apr. 15, 1955, p. 359-367.

Attempts to correlate thermo-electric power and thermol conductivity of bismuth, with its susceptibility, magnetoresistance and Hall coefficient on exhibiting the same type of magneto-oscillatory behavior. Tables, graphs. 23 ref. (P16, P11, Bi)

- 178-P. (German.) Aluminum as a Conducting Material. E. Nachtigall. *Elektrotechnik und Maschinenbau*, v. 72, no. 5, Mar. 1, 1955, p. 99-105.
- Electric characteristics; influence of impurities; fields of application. Tables, diagrams. 8 ref. (P11, T1, Al)
- 179-P. (Russian.) Problem of Temperature Dependence of Surface Tension of Metals. S. N. Zadumkin. *Doklady Akademii Nauk SSSR*, v. 101, no. 3, Mar. 21, 1955, p. 507-509.
- Mathematical treatment. Table. 19 ref. (P12)
- 180-P. (Russian.) Determination of the Activity of Iron Oxide in Molten Slags by the Method of Electrodynamic Forces. O. A. Esin, B. M. Lepinskikh and V. I. Musikhin. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1954, no. 12, Dec., p. 120-127.
- Thermodynamic properties of Ca-O-Fe-SiO₂ melts. Method avoids laborious chemical analysis. Change of isobar potential. Phase diagram, tables, graphs. 13 ref. (P12, ST)
- 181-P. (Russian.) The Goldhammer Effect in Alloys of a Ternary System of Iron, Nickel, and Cobalt. N. V. Grum-Grzhimailo. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1954, no. 12, Dec., p. 137-139.
- Relation of relative variations of electric resistance, under the influence of a longitudinal magnetic field, to the electronic states of the outer orbits. Table, phase diagram. 5 ref. (P15, Fe, Ni, Co)
- 182-P. (Russian.) Investigation of the Resistance to Growth of Magnesium Cast Iron. A. D. Ushakov. *Litinoes Proizvodstvo*, 1955, no. 4, Apr., p. 22-23.
- Dilatometric study of volume changes. Micrographs, graphs, table. (P10, CI)
- 183-P. (Russian.) Investigation of the Thermoelectrical Properties of Bismuth Telluride. R. M. Vlasova and L. S. Stil'ians. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 569-576.
- Effect of temperature on conductivity and Hall effect of electronic and vacancy types. Analysis of test methods. Circuit diagrams, graphs, table, diagrams. 5 ref. (P15, Bi, Te)
- 184-P. (Russian.) Nernst-Ettingshausen Thermomagnetic Effect in Tellurium. A. Z. Daibov and I. M. Tsidil'kovskii. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 742-746.
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- 187-P. Heat Treatment Practice in Relation to the Dimensional Stability of Steel. N. J. Sheppard. *Australasian Engineer*, 1955, Mar., p. 46-56.
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- 194-P. Use of the Instron Tensile Testing Machine to Observe Resistance Recovery. Herman M. Dieckamp and Charles J. Meechan. *U. S. Nuclear Engineering and Manufacturing, NAA-SR-MEMO-107*, 1955, 17 p.
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- 199-P. Rate of Heat Absorption of Steel. Fred S. Bloom. *Iron and Steel Engineer*, v. 32, May 1955, p. 64-74; disc., p. 74-76.
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- 201-P. A Study of the Thermal Diffusion Equation With Boundary Conditions Corresponding to Solidification or Melting of Materials Initially at the Fusion Temperature. F. Kreith and F. E. Romie. *Physical Society, Proceedings*, v. 68, no. 425B, May 1955, p. 277-291.
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studied. Diagrams, graphs. 14 ref. (P12, Au, Ni)

205-P. (Russian.) Oxidation of Phosphorus Dissolved in Liquid Iron and the Effect of Phosphorus on the Solubility of Oxygen. N. P. Levenets and A. M. Samarin. *Doklady Akademii Nauk SSSR*, v. 101, no. 6, Apr. 21, 1955, p. 1089-1092.

Reaction equations. Variation of activity of the oxygen and phosphorus explained by the formation of triphosphate of iron and other compounds of phosphorus with iron. Graphs. 2 ref. (P12, Fe)

206-P. (Russian.) Optical Properties of Metals. V. L. Ginzburg and G. P. Motulevich. *Uspekhi Fizicheskikh Nauk*, v. 55, no. 4, Apr. 1955, p. 469-535.

Reflection from metal surfaces; surface impedance and dielectric properties. Graphs, diagrams, tables. 64 ref. (P17, Cu, Ag, Au, Sn, Al)

Tests were run at 500 and 700° F. at stresses of 148 to 786 psi. Based on these measurements and theoretical calculations, the crystallographic elements for nonbasal slip were determined. Micrographs, diagrams, tables. 12 ref. (Q3, Mg)

561-Q. Fatigue and the Comet Disasters. Tom Bishop. *Metal Progress*, v. 67, May 1955, p. 79-85.

Engineering and metallurgical tests carried out to determine cause of the accidents. Photographs, graph, diagram. (Q7)

562-Q. Lubricants for Titanium. Ernest Rabinowicz and E. P. Kingsbury. *Metal Progress*, v. 67, May 1955, p. 112-114.

Certain long-chain hydrocarbons with active atomic groupings attached along the chain are best so far discovered; they reduce the coefficient of friction by two thirds, and wear by a factor of ten or more. Graph, diagram. (Q9, Ti)

563-Q. Hydrogen Embrittlement of Titanium Alloys. Harris M. Burke, Eugene F. Erbin, George T. Hahn, Ralph J. Kotfila, John W. Seeger and Donald A. Wruck. *Metal Progress*, v. 67, May 1955, p. 115-120.

Embrittlement observed in the laboratory at levels as low as 150 p.p.m. Tables, graphs. (Q23, Ti)

564-Q. Exact Reduction and Solution by Parts of Equations for Elastic Structures. Börje Lange fors. *SAAB Aircraft Company, Technical Notes*, SAAB TN 24, 1953, 9 p.

Matrix equations for elastic structures and similar physical systems are established by using elastic and topological properties. 9 ref. (Q21, Q25)

565-Q. A Suggested Method for Calculating the Stresses in Wings With Nonrectangular Plates. Börje Lange fors. *SAAB Aircraft Company, Technical Notes*, SAAB TN 23, 1953, 11 p.

Analysis of oblique plates by the aid of superposition of elementary solutions. Diagrams. 5 ref. (Q25)

566-Q. On Traveling Waves in Beams. Robert W. Leonard and Bernard Budiansky. *U. S. National Advisory Committee for Aeronautics, Report* 1173, 1954, 27 p.

Numerical traveling-wave solutions are obtained for some elementary problems of finite uniform beams for which the propagation velocities of bending and shear discontinuities are taken to be equal. Table, graphs. 18 ref. (Q2, Q5)

567-Q. (English.) New Methods for Computing Parameters of Complete or Truncated Distribution. Waloddi Weibull. *Aeronautical Research Institute of Sweden, Report* 58, 1955, 21 p.

Methods applicable to truncated or censored distributions which may be required when dealing with distributions composed of more than one component or with fatigue tests stopped at some predetermined time before all the specimens have failed. Tables, graphs. 3 ref. (Q7)

568-Q. (German.) Indication of the Brittleness of Steel by Determining Its Yield Point, Tensile Strength, and Resistance to Necking in Triaxially Stressed Test Specimens. Albert Kochendörfer and Christof Rohrbach. *Archiv für das Eisenhüttenwesen*, v. 26, no. 4, Apr. 1955, p. 213-229.

Method and material used. Composition of steels and heat treatment. Shape of test specimens. Tables, diagrams, photographs. 28 ref. (Q23, Q27, ST)

569-Q. (German.) Structure, Mechanical Behavior, and Standardization of Gray Cast Iron in the Light of a

Bivariant System. A. Collaud. *Schweizer Archiv für angewandte Wissenschaft und Technik*, v. 21, no. 4, Apr. 1955, p. 105-117.

Relation between structure and mechanical properties. Tables, diagrams. (Q general, M general, CI)

570-Q. (Russian.) Poisson's Ratio in the Plastic Range. A. M. Zhukov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1954, no. 12, Dec., p. 86-91.

Correlation of work of various experimenters on determination of Poisson's ratio of aluminum and steel at 350 and 750° C. Graphs, tables. 12 ref. (Q21, Al, ST)

571-Q. (Russian.) Peculiarities of the Deformation of Monocrystalline and Polycrystalline Copper During High-Temperature Heating in a Vacuum. M. G. Lozinskii and S. G. Fedotov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1954, no. 12, Dec., p. 92-96.

Effect of grain size on strength; "viscous" behavior of grain boundaries; effect of temperature on crystal orientation and hardness. Micrographs, graphs, diagram. 8 ref. (Q24, M26, Cu)

572-Q. (Russian.) Investigation of the Mechanical Properties of White Cast Iron and the Stresses in It. L. I. Kozhinskii. *Litinoe Proizvodstvo*, 1955, no. 4, Apr., p. 19-22.

Modulus of elasticity and bending strength determinations. Effects of carbon content and other constituents. Diagrams, graphs, tables, micrographs. 4 ref. (Q21, Q5, CI)

573-Q. (Russian.) Thermoplastic After Effect in Metals. I. N. N. Davydov and D. M. Vasil'ev. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 671-679.

Dilatometric measurements on steels during heating. Relation of magnitude of after effect to carbon content, impurities and previous heat treatment. Graphs, tables, diagram. 4 ref. (Q7, ST)

574-Q. (Russian.) Relation of Rate and Relaxation Coefficients of Aluminum to the Rate of Plastic Deformation. L. I. Vasil'ev. *Zhurnal Tekhnicheskoi Fiziki*, v. 25, no. 4, Apr. 1955, p. 687-690.

Experimental data. Explanation of regularities observed. Graphs. 4 ref. (Q24, Al)

575-Q. Testing Fatigue Life of Skin Panels. Edward Schiff. *Aero Digest*, v. 70, May 1955, p. 42, 44, 46.

Simple water pressure system yields rapid cyclicization of specimens and provides automatic cut-off at failure. Diagram, photographs. (Q7)

576-Q. Application of Photoelasticity to the Design of Tensile Specimens for Ceramic-Metal Materials. M. B. Stiefel. *American Ceramic Society Bulletin*, v. 34, May 1955, p. 133-137.

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Tensile results on bars tempered between 400 and 600° C. for times up to 4 hr., and unnotched and notched fatigue results on specimens tempered for 2 hr. at 550 and 600° C. Tables, micrographs, graphs, diagrams. 11 ref. (Q27, Q7, CI)

Mechanical Properties and Test Methods; Deformation

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Mean pressure and radial wall stresses measured during the extrusion of commercially pure lead. Diagrams, graphs. 6 ref. (Q24, F24, Pb)

557-Q. Fatigue Tests on Rolled Alloy Steels Made in Electric and Open-Hearth Furnaces. P. H. Frith. *Iron and Steel Institute, Journal*, v. 180, May 1955, p. 26-33 + 3 plates.

Longitudinal and transverse reversed bending fatigue properties obtained for basic electric-arc and acid openhearth steels. Tables, micrographs. (Q7, AY)

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Constant strain rate tensile tests were performed between room temperature and 1800° F. Data analyzed to determine effect of temperature and composition on the strain hardening coefficient and strain rate sensitivity. Tables, graphs, micrographs. 30 ref. (Q27, Fe, Mo)

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Effect of dislocation boundaries on flow stress under the following experimental conditions; substantially pure shear deformation, and boundaries of controlled angle, orientation and number. Diagrams, photographs, graphs, micrographs. 15 ref. (Q23, Zn)

560-Q. Creep Deformation of Magnesium at Elevated Temperatures by Nonbasal Slip. A. R. Chaudhuri, H. C. Chang and N. J. Grant. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, May 1955, p. 682-688.

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- 579-Q. The Cracking of Layers of Brittle Material by Differential Strains.** D. J. Millard. *British Journal of Applied Physics*, v. 6, Apr. 1955, p. 124-127.
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- 580-Q. The Solution of Plane Stress Problems by an Electrical Analogue Method.** G. Liebmann. *British Journal of Applied Physics*, v. 6, May 1955, p. 145-151.
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- 582-Q. Assessment of Spot-Weld Quality by Torsion Test.** P. Jourmat and J. E. Roberts. *British Welding Journal*, v. 2, May 1955, p. 225-233.
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- 583-Q. The Determination of the Elastic Constants of Metals by an Ultrasonic Method.** E. G. Ramachandran and N. Srinivasan. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 173-188; disc., p. 259-260.
- Elastic constants of polycrystalline metals as well as of single crystals of metals have been determined. Photographs, diagrams, tables. 8 ref. (Q21)
- 584-Q. Brittle Fracture.** T. S. Robertson. *Iron & Steel*, v. 28, May 1955, p. 161-166.
- Test methods, theory and mechanism of fractures. Photographs, graphs. (Q26, Q23)
- 585-Q. Variable Creep Strength.** W. E. Bardgett and M. G. Gemmill. *Iron & Steel*, v. 28, May 1955, p. 239-242.
- Creep strength results of basic openhearth mild steel, killed with varying amounts of aluminum, show importance of the (residual) soluble aluminum content of the solid steel as a control factor. Graphs, tables. (Q3, CN, Al)
- 586-Q. Creep and Rupture.** J. Glen. *Iron & Steel*, v. 28, May 1955, p. 242-252.
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- 587-Q. Precision-Cast High Temperature Alloy.** G. T. Harris and H. C. Child. *Iron & Steel*, v. 28, May 1955, p. 252-255.
- Statistical study of creep and fatigue properties. Graphs. (Q3, Q7, Co)
- 588-Q. Creep and Tensile Properties.** A. Graham and K. F. A. Wallis. *Iron & Steel*, v. 28, May 1955, p. 255-263.
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- Velocity of shock waves and associated translational motions, produced by metal-metal impact, determined by electrical contact technique. Results used to evaluate equation of state for the metal. Tables, graphs, diagram. 6 ref. (Q general, Al)
- 590-Q. Internal Friction of an Alloy of 16 Percent Aluminum in Iron.** C. Wert. *Journal of Applied Physics*, v. 26, May 1955, p. 640-641.
- Measurements of internal friction of "16-Alfenol". Graph. 4 ref. (Q22, Fe, Al)
- 591-Q. Impact Pressure Loading of Rigid-Plastic Cylindrical Shells.** P. G. Hodge, Jr. *Journal of the Mechanics and Physics of Solids*, v. 3, Apr. 1955, p. 176-188.
- Considers a shell, loaded for a short time with a pressure greater than the collapse load; expressions for the stresses, velocities and displacements are found in each case. Diagrams, graphs, table. 8 ref. (Q25)
- 592-Q. On Unsymmetrical Extrusion in Plane Strain.** A. P. Green. *Journal of the Mechanics and Physics of Solids*, v. 3, Apr. 1955, p. 189-196 + 3 plates.
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- 593-Q. X-Ray Microbeam Studies of Brittle Fractures of Metals.** Lo-Ching Chang. *Journal of the Mechanics and Physics of Solids*, v. 3, Apr. 1955, p. 212-217 + 1 plate.
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- 594-Q. Researches on the Fatigue Under Consideration of the Phenomenon of Elastic Hysteresis.** Minoru Kamamoto and Kunio Nishikawa. *Kyoto University, Memoirs of the Faculty of Engineering*, v. 17, no. 1, Jan 1955, p. 1-29.
- Relation between stress and strain on the metallic material subjected to the reversed stress and the condition of fatigue limit; effect of shape of cross section of specimen on fatigue limit; relation between the form and notch factors. Diagrams, graphs, tables. 22 ref. (Q7)
- 595-Q. Modified 18-8 Stainless for Higher Temperatures.** *Materials & Methods*, v. 41, May 1955, p. 117-118.
- Use of nonstrategic metals to replace nickel. Effects of various modifying elements on mechanical properties at elevated temperatures. Photographs, table. (Q general, SS)
- 596-Q. Overlay Bearings.** J. B. Mohler. *Metal Industry*, v. 86, May 6, 1955, p. 375-378.
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- Practical application of the method to the nondestructive testing of low-alloy content steel components. Photograph, diagrams, tables, graphs. (To be continued.) (Q29, AY-n)
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- 599-Q. Effect of Welding on Transition Temperature of Nickel Steel Plate.** T. N. Armstrong and W. L. Warner. *Welding Journal*, v. 34, May 1955, p. 209S-215S.
- Welding does not appreciably lower the transition temperature of low-carbon, 3½% nickel steel plate, particularly if welds are stress-relieved. Graphs, tables, photographs. 3 ref. (Q23, K general, J1, AY)
- 600-Q. The Static and Fatigue Behavior of Spot-Welded Joints in Titanium.** W. H. Kearns, W. S. Hyler and D. C. Martin. *Welding Journal*, v. 34, May 1955, p. 241S-250S.
- Spot-welded joints in tension-shear tests were stronger than similar joints in stainless steel and aluminum alloys. They were also stronger in fatigue tests as compared with aluminum alloys but somewhat lower than stainless steel. Tables, diagrams, graphs. 4 ref. (Q7, K3, Ti)
- 601-Q. (German.) Effect of Various Alloying Elements on the Properties of Austenitic Chromium-Nickel Steels Showing High Strength at Elevated Temperatures in the Temperature Range of From 600 to 700° C.** Hanns Arnt Vogels. *Stahl und Eisen*, v. 75, no. 9, May 5, 1955, p. 559-570.
- Effect of the pretreatment on the hot shaping property, creep strength, tendency to embrittlement, and resistance to scaling. Tables, diagrams, graphs, micrographs. 17 ref. (Q24, Q3, Q23, R2, SS)
- 602-Q. (German.) Transformation and Segregation Phenomena in Austenitic Chromium-Nickel Steels at Elevated Temperatures.** Ewald Baerlecken and Walter Hirsch. *Stahl und Eisen*, v. 75, no. 9, May 5, 1955, p. 570-579.
- Effect of carbon, silicon, manganese, molybdenum, columbium, nitrogen, titanium and vanadium contents on the structure, magnetic saturation, notch toughness, hardness and resistance to grain disintegration in a boiling copper sulfate-sulfuric acid solution after an annealing treatment of up to 18,500 hr. at 600 to 850° C. Tables, micrographs, graphs. 34 ref. (Q general, R5, SS)
- 603-Q. (Hungarian.) Investigation of the Wear Resistance of Modified Cast Iron in Laboratory and Railway-Operation.** Ferenc Varga and Endre Füle. *Ontöde*, v. 6, no. 4, Apr. 1955, p. 85-91.
- Wear resistance of calcium-silicate modified cast iron as compared to the ordinary and iron-silicon modified types; improvements in wear resistance. Micrographs. (Q9, CI)
- 604-Q. (Polish.) High-Alloy Steels With Nitrogen Addition.** Adam Semkowicz. *Hutnik*, v. 22, no. 1, 1955, p. 8-12.

- Variations in heat treatment; strength, hardness and resistance to corrosion and chemical reagents of chromium-nickel steels with and without nitrogen. Tables, micrographs, graphs. 9 ref. (Q23, Q29, J general, R general, AY)
- 605-Q.** (Russian.) Investigation of the Basic Parameters of the Wear of Gears. G. I. Skundin. *Avtomobil'naya i traktornaya promyshlennost'*, 1955, no. 4, Apr., p. 9-12.
- Factors include effect of dust, nonparallelism of grooves, warp and crumpling stresses, period of operation and hardness of gear slots. Photographs, tables. (Q8)
- 606-Q.** (Russian.) Theory of Small Elasto-Plastic Deformations of Anisotropic Media. I. I. Gol'denblat. *Doklady Akademii Nauk SSSR*, v. 101, no. 4, Apr. 1, 1955, p. 619-622.
- Mathematical analysis. 2 ref. (Q24)
- 607-Q.** (Russian.) Elastic Twinning of Metals. V. I. Startsev and V. M. Kosevich. *Doklady Akademii Nauk SSSR*, v. 101, no. 5, Apr. 1, 1955, p. 861-864.
- Alternating application and removal of varying stresses or bending and the occurrence of elastic twins; intergranular lattice damage. Micrographs. 6 ref. (Q24, Sb, Bi)
- 608-Q.** (Russian.) Strength and Plasticity of Metals at Low and Extremely Low Temperatures. G. V. Uzhik. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1955, no. 1, Jan., p. 57-66.
- Variations resulting in shearing strength; plastic deformation; twinning, etc. Graphs, diagrams, table. 7 ref. (Q23, Q24, AY, CN, SS, CI, Cu, Al, Cd)
- 609-Q.** (Russian.) Internal Friction of Steel in Relation to Temper (Thermal) Brittleness. E. I. Kvashnina and V. I. Prosvirin. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, 1955, no. 1, Jan., p. 157-159.
- Effect of heating at 500° C. of brittle steel; high-temperature tempering and subsequent heating at 500° C.; effect of molybdenum on steel. Graphs. 3 ref. (Q22, Q23, ST, Mo, Cr, Mn)
- 610-Q.** Statistico-Mechanical Theory of Deformation, Involving the Activated State. W. James Lyons. *American Journal of Physics*, v. 23, May 1955, p. 268-275.
- Relative concentration of activated units; specific rate of transfer; equation for rate of deformation. Diagram, graphs. 17 ref. (Q24)
- 611-Q.** The Stresses in a Simple Supported Reinforced Annular Plate Uniformly Loaded. Irving Granet. *American Society for Naval Engineers, Journal*, v. 67, May 1955, p. 513-520.
- Develops equations for the stresses and deflections; compares the material economics in using a reinforced hub. Diagrams. 5 ref. (Q25)
- 612-Q.** The Effect of Trace Impurities on the Properties of Iron. N. P. Allen. *Birmingham Metallurgical Society, Journal*, v. 35, Mar. 1955, p. 169-180.
- Experimental results, discussion of the brittleness of iron and its alloys. Graphs, tables, photographs. (Q23, ST, Fe)
- 613-Q.** Test of Corrugated Steel Pipe Culvert at Cullman, Alabama. *Engineer*, v. 199, May 6, 1955, p. 646-647.
- Tests on an 84-in. diam. Armco "multi-plate" culvert situated under 137 ft. of fill. Results indicate that such pipe can readily be used under high fills provided that the structure is properly back-filled. Photographs, diagram, graph. (Q23, CN)
- 614-Q.** Creep-Relaxation Testing Tests at Constant Strain and Decreasing Load. John H. M. Draper. *Engineering*, v. 179, May 6, 1955, p. 564-565.
- Method of maintaining constant strain; test procedures; effect of loading at different rates and temperatures. Diagram, graphs. 1 ref. (Q3, AY)
- 615-Q.** Short-Time Creep-Relaxation Tests. Effect of Methods of Loading. S. J. Watson. *Engineering*, v. 179, May 6, 1955, p. 565-566.
- Four creep-relaxation tests, carried out at 600° C. with a strain of 0.153% (corresponding to a stress of 20 tons per sq. in. at 20° C.) but differing in the way in which the strain was applied. Diagrams, graphs. (Q3, AY)
- 616-Q.** Fatigue Life of Steel I-Beams At Normal and Sub-Zero Temperatures. J. Dubuc, Jr., T. A. Monti and George Welter. *Engineering Journal*, v. 38, May 1955, p. 607-614, 626.
- Testing apparatus; behavior of each type of beam under series of fatigue flexure tests related. Photographs, diagrams, graphs. (Q7, ST)
- 617-Q.** Mechanical Properties of Cast Titanium-Aluminum-Silicon Alloys. H. W. Antes and R. E. Edelman. *Foundry*, v. 83, June 1955, p. 92-95.
- Effect of silicon on mechanical properties. Silicon additions up to 1% were made to both 4 and 6% aluminum-titanium alloys. In both series of alloys, an increase of about 4000 psi. was realized for each 0.1% of silicon added. Micrographs, diagram, tables, graphs. 7 ref. (Q general, Ti)
- 618-Q.** Problems Connected With the Rhombus. II. Plastic Torsion. K. T. Sundara, Raja Iyengar and S. K. Lakshmana Rao. *Indian Institute of Science, Journal*, v. 37, sec. B, Apr. 1955, p. 113-120.
- Relaxation technique used to obtain a numerical solution in the case of plastic torsion. Diagram, graph. 2 ref. (Q1)
- 619-Q.** Inhomogeneous Deformation in Rolling and Wire-Drawing. B. B. Hundt and A. R. E. Singer. *Institute of Metals, Journal*, v. 83, May 1955, p. 401-407.
- Relation of the degree of inhomogeneity to conditions of working. Tables, graphs, diagram. 25 ref. (Q24)
- 620-Q.** Deformation and Annealing Textures in Thorium. R. E. Smallman. *Institute of Metals, Journal*, v. 83, May 1955, p. 408-416 + 1 plate.
- Work on deformation and annealing textures, of interest from both a practical and a theoretical standpoint. Diagrams, tables, graphs. 34 ref. (Q24, Th)
- 621-Q.** A Preliminary Note on the Creep Properties of Internally Oxidized Copper Alloys. J. W. Martin and G. C. Smith. *Institute of Metals, Journal*, v. 83, June 1955, p. 417-420 + 1 plate.
- Creep properties of single-crystal and poly-crystalline specimens determined with and without a dispersed oxide phase. Graphs. 7 ref. (Q3, Cu)
- 622-Q.** Some Observations on the Creep of Pre-Strained Aluminium. G. R. Wilms. *Institute of Metals, Journal*, v. 83, May 1955, p. 427-432 + 2 plates.
- Changes which occur in the structure during subsequent creep deformation under constant tensile load at various temperatures. Graphs. 17 ref. (Q3, Al)
- 623-Q.** Rare Earths Improve Impact Properties of 4330. H. Schwartzbart and J. P. Sheehan. *Iron Age*, v. 175, May 26, 1955, p. 103-106.
- Rare earths can increase toughness without affecting hardness. Table, graphs. (Q6, AY)
- 624-Q.** Prediction of Creep-Deflection and Stress Distribution in Beams From Creep in Tension. W. N. Findley and J. J. Foczatek. *Journal of Applied Mechanics*, v. 22, June 1955, p. 165-171.
- Method of predicting creep in bending from data on creep in tension derived and applied to creep of a canvas laminate. Deflections compared favorably with test data. It was shown that stress distribution remained constant during creep in bending when creep in tension and compression were equal and the coefficient of the time-dependent term was equal to the time-independent term. Methods of determining creep deflections of beams having nonuniform bending moments. Graphs. 24 ref. (Q3)
- 625-Q.** Fracture of Inoculated Iron Under Biaxial Stresses. I. Cornet and R. C. Grassi. *Journal of Applied Mechanics*, v. 22, June 1955, p. 172-174.
- Data on fracture of inoculated-iron thin-wall tubes investigated under various ratios of axial to tangential stress, ranging from pure tension to pure compression. Data consistent with published data on gray cast iron. Diagrams, graph. 7 ref. (Q26, CI)
- 626-Q.** The Formation of a Conical Crater in a Thin Plastic Sheet. W. T. Thomson. *Journal of Applied Mechanics*, v. 22, June 1955, p. 175-176.
- Deformation of a thin plastic sheet forced by a conical mandrel. Diagram, graph. (Q24)
- 627-Q.** Further Work on the General Three-Dimensional Photoelastic Problem. Max M. Frocht and Roscoe Guernsey, Jr. *Journal of Applied Mechanics*, v. 22, June 1955, p. 183-189.
- A general, practical method of solution. Possible variations in procedure. Diagrams, graphs, table, stress patterns. 14 ref. (Q25)
- 628-Q.** Stress-Concentration Factors in Shafts With Transverse Holes as Found by the Electroplating Method. H. Okubo and S. Safo. *Journal of Applied Mechanics*, v. 22, June 1955, p. 193-196.
- Torsion of shafts with transverse holes investigated experimentally. Graph, tables, photographs, diagram. 6 ref. (Q25)
- 629-Q.** Load Distribution at the Intersection of Several Coaxial Axisymmetric Shells. H. Becker. *Journal of Applied Mechanics*, v. 22, June 1955, p. 232-234.
- Theory; shear load-distribution cycle, special cases, application of method. Diagrams. (Q25)
- 630-Q.** Solving Highly Complex Elastic Structures in Easy Stages. Gabriel Kron. *Journal of Applied Mechanics*, v. 22, June 1955, p. 235-244.
- A systematic procedure solves very large elastic structures, containing hundreds of component elements. Method is not competitive with existing techniques of solving sets of linear equations but is to be used only when other methods prove inadequate to cope with the capacity of the available computer (slide rule or electronic). Diagrams, graph. 16 ref. (Q25)
- 631-Q.** On the Nonlinear Differential Equation for Beam Deflection. E. J. Scott and D. R. Carver. *Journal of Applied Mechanics*, v. 22, June 1955, p. 245-248.

- General solution of nonlinear beam equation given for all problems in which the moment can be expressed as a function of the independent variable alone. Graphs. (Q25)
- 632-Q.** Problems of Plane Elasticity for Reinforced Boundaries. J. R. M. Radok. *Journal of Applied Mechanics*, v. 22, June 1955, p. 249-254.
- General method deducted for investigation of stress distribution around compactly reinforced holes in infinite plates. Tables, graphs, diagram. 8 ref. (Q25)
- 633-Q.** Stress Distribution in a Uniformly Rotating Equilateral Triangular Shaft. H. T. Johnson. *Journal of Applied Mechanics*, v. 22, June 1955, p. 255-259.
- General method employed which may be applied in obtaining approximate solutions for the stress distribution for rotating prismatic shapes, for the cases of either generalized plane stress or plane strain. Graphs, tables. 6 ref. (Q25)
- 634-Q.** Further Problems in Orthotropic Plane Stress. H. D. Conway. *Journal of Applied Mechanics*, v. 22, June 1955, p. 260-262.
- Solution for the infinite orthotropic plate containing an elliptical hole, the plate being subjected to tension at infinity and the axes of the hole and the direction of the tension inclined at arbitrary angles to the principal axes of orthotropy. (Q25)
- 635-Q.** Stresses Due to Diametral Forces on a Circular Disk With an Eccentric Hole. A. M. Sen Gupta. *Journal of Applied Mechanics*, v. 22, June 1955, p. 263-266.
- Stresses determined when disk is compressed along the line of centers by two equal and opposite forces acting on its outer edge, the inner edge being unstressed. From results obtained, solution of the problem of a semi-infinite plate acted on by a concentrated normal force on its straight boundary and containing an unstressed circular hole deduced. Tables, graph, diagram. (Q25)
- 636-Q.** Bending of Orthogonally Stiffened Plates. W. H. Hopmann. *Journal of Applied Mechanics*, v. 22, June 1955, p. 267-271.
- Flexure theory for plates of orthotropic material applied in the case of orthogonally stiffened plates using an experimental method to determine plate stiffnesses in bending and in twisting. Diagrams, graphs, tables, photograph. 16 ref. (Q25)
- 637-Q.** A Single-Profile Crystal Extensometer Adjustable for Orientation. A. J. Kennedy. *Journal of Scientific Instruments*, v. 32, May 1955, p. 183-185.
- Design of the device. Table, diagrams. 8 ref. (Q27)
- 638-Q.** Directional Properties in Aluminum. P. Grodzinski. *Light Metals*, v. 18, May 1955, p. 155-156.
- Use of elongated indenters for determination of hardness variations in aluminum single crystals. Diagrams, graphs, micrograph. 6 ref. (Q29, Al)
- 639-Q.** Brittle Failure of Steel Structures—Theory, Practice, Future Prospects. M. E. Shank. *Metal Progress*, v. 67, June 1955, p. 111-121.
- Some important theoretical and experimental developments in the field of inquiry, along with views on present engineering design and fabrication practice and future possibilities. Micrographs, diagrams, graphs. 28 ref. (Q26, Q28, ST)
- 640-Q.** A Slip-Band Exudation Effect Observed in Pure Aluminum. P. J. E. Forsyth and C. A. S. Stubbington. *Nature*, v. 175, Apr. 30, 1955, p. 767-768.
- Exudation is thought to be caused by cyclic stresses on a thin sandwich of material depleted of solute atoms. Micrographs. 2 ref. (Q24, Q7, Al)
- 641-Q.** The Outlook on Airframe Fatigue. Walter Tye. *Royal Aeronautical Society, Journal*, v. 59, May 1955, p. 339-348.
- Safe life of spars, wing tests, pressure cabin testing, tail planes, present situation and immediate future. Graphs, photographs. 10 ref. (Q7)
- 642-Q.** The Value of Hardness Testing as Inspection Procedure. W. G. Shilling. *Sheet Metal Industries*, v. 32, no. 337, May 1955, p. 373-377; disc., p. 377-384.
- Practical aspects of the tests and their application by inspectors. Photographs, table, graph, histograms. (Q29)
- 643-Q.** Friction, Wear, and Surface Damage of Metals as Affected by Solid Surface Films. Edmond E. Bisson, Robert L. Johnson, Max A. Swikert and Douglas Godfrey. U. S. National Advisory Committee for Aeronautics, Technical Note 3444, May 1955, 60 p.
- Results of investigations, from 1946 to 1954, are consistent with theoretical predictions that solid surface films of low shear strength can serve to reduce both friction and surface damage, with metallic oxides having very marked effects. Graphs, diagrams, micrographs, tables. 48 ref. (Q8)
- 644-Q.** (English.) Internal Friction in Solid Solutions of Oxygen-Tantalum. R. W. Powers. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 135-139.
- Study to determine if the relative width of a damping curve depends in any manner on the peak height or interstitial atom concentration. Table, diagram, graphs. 8 ref. (Q22, Ta)
- 645-Q.** (English.) Mechanism of Pore Formation Associated With the Kirkendall Effect. J. A. Brinkman. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 140-145.
- A mechanism proposed by which tensile stress can nucleate voids of a critical size or larger. Diagram. 13 ref. (Q24)
- 646-Q.** (English.) A Uniaxial Strain Model for a Lüder's Band. E. W. Hart. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 146-149.
- A model is proposed to explain the load-elongation test behavior for a wide range of types of materials which exhibit yield point phenomena in one form or another. Graphs. 7 ref. (Q24)
- 647-Q.** (English.) Twinning and Accommodation Kinking in Zinc. A. J. W. Moore. *Acta Metallurgica*, v. 3, no. 2, Mar. 1955, p. 163-169.
- Examples described and compared with metallographic sections of the same twins, possible importance in the development of the twin discussed. Diagrams, micrographs, graphs. 16 ref. (Q24, Zn)
- 648-Q.** (Czech.) Application of Microstructure Analysis for Technology of Plastic Magnesium Alloys. Petr Skutari. *Hutnické Listy*, v. 10, no. 4, Apr. 1955, p. 209-215.
- Advantages of microstructure analysis for technology of plastic magnesium alloys and the influence of hexagonal lattice on the mechanical and technological characteristics of these alloys. Diagrams, graphs, table. 6 ref. (Q24, Mg, Al)
- 649-Q.** (German.) The Deformability of Anodically Oxidized Pure Aluminum. Walter Köhler. *Werkstoffe und Korrosion*, v. 6, no. 4, Apr. 1955, p. 189-190.
- Influence of various coating-methods on the deformability of anodically oxidized semifinished products and the tendency of the oxide layers to crack under tensile stresses and wear conditions. Graphs, micrographs, tables, photographs. 32 ref. (Q24, Li4, Al)
- 650-Q.** (Russian.) Cast Copper Anti-friction Steels. A. A. Lunev. *Litinoe Proizvodstvo*, 1955, no. 5, May, p. 15-18.
- Effect of lubricants, copper coatings and various heat treatments on the co-efficient of friction of copper-aluminum steel. Other bearing metals and combinations also tested. Micrographs, graphs, tables, phase diagram. 13 ref. (Q9, AY, SG-c)
- 651-Q.** (Russian.) Increasing the Strength of Welded Rails of New-Type Steels by Means of Mechanical and Heat Treatment of the Butt Joints. I. Z. Genkin. *Svarochnoe Proizvodstvo*, 1955, no. 5, May, p. 5-9.
- Comparison of fatigue strength, etc. of whole rails, bolt joints and rails welded by contact, thermit and other methods. Effect of polishing, annealing, etc. Microstructure of steels at weld union. Tables, graphs, micrographs, diagrams. (Q23, Q7, J general, M27, ST)
- 652-Q.** (Russian.) Analysis and Application of Certain Criteria of Creep. I. A. Odinc and V. S. Ivanova. *Vestnik Mashinostroeniya*, v. 35, no. 5, May 1955, p. 62-66.
- Values of co-efficients of long-range strength and of creep for several steels. Factors affecting plasticity and "reserve" properties and their relation to the period of service before fracturing. Tables, graphs. (Q3, ST)
- 653-Q.** (Book.) Titanium in Iron and Steel. George F. Comstock. Alloys of Iron Research, New Monograph Series. 294 p. 1955. John Wiley & Sons. 440 4th Ave., New York 16, N. Y.
- Effect of titanium on properties and behavior of carbon and alloy steels and cast iron. (Q general, Ti, CN, AY, CI)
- 654-Q.** (Book—German.) Testing Metals. Eugen Hanke. 633 p. 1954. VEB Verlag Technik, Berlin, Germany.
- Destructive and nondestructive methods for determining mechanical, physical, chemical, and electrical properties; procedures, testing equipment, preparation of specimens; effect of chemical composition and other factors on properties and structure. (Q general, P general, S general)

R Corrosion

655-R. Action of Boiler Water on Steel—Attack by Bonded Oxygen. C. E. Kaufman, W. H. Trautman, and W. R. Schnarrenberger. *ASME Transactions*, v. 77, May 1955, p. 423-430; disc., p. 430-432.

Information relating to attack by boiler water on steel of boilers and superheaters. Table, diagrams, photographs, micrographs. 16 ref. (R4, ST)

- 235-R.** Corrosion of Steel in Boilers—Attack by Dissolved Oxygen. H. A. Grabowski. *ASME, Transactions*, v. 77, May 1955, p. 433-441; disc., p. 441-448.
- Various theories that have been proposed to explain the severe, although local, corrosion of furnace-wall tubes in high-pressure boilers. Metallurgical significance of failures and welding techniques also discussed. Photographs, micrographs, graphs. 4 ref. (R4, ST)
- 236-R.** Causes of Catalytic Corrosion. (Digest of "Catalytic Corrosion," by S. Z. Roginskii, I. I. Tret'yakov and A. B. Shekhter; *Doklady Akademii Nauk SSSR*, v. 91, 1953, p. 881-884.) *Metal Progress*, v. 67, May 1955, p. 177-178, 180.
- Previously abstracted from original. See item 37-R, 1954. (R1)
- 237-R.** Investigation of Accident Involving Titanium and Red Fuming Nitric Acid, December 29, 1953. P. M. Ambrose, J. C. Barrett, R. W. Huber, David Schlain and V. C. Petersen. *U. S. Bureau of Mines, Information Circular* 7711, Mar. 1955, 34p.
- Stress-corrosion testing of spot-welded titanium samples in red fuming nitric acid and investigation of explosion occurring during test. Tables, micrographs, photographs, diagram. (R1, Ti)
- 238-R.** Coatings and Cathodic Protection for Steel Pipelines. II. G. I. Russell. *Corrosion Prevention and Control*, v. 2, May 1955, p. 21-24.
- Joint use of cathodic protection and a high-quality coating combination will continue to provide the best performance at minimum projected total cost. Photographs. 7 ref. (R10, L general, CN)
- 239-R.** Corrosion in the Brewing Industry. *Corrosion Technology*, v. 2, Apr. 1955, p. 117-119.
- Cost of corrosion; paints and protective coatings; use of zinc-rich coatings; epoxy-type resin; future developments. (R7, L26, Zn)
- 240-R.** How Richfield Tackled Hydrogen Blistering. B. W. Neuheimer and C. M. Schillmoller. *Oil and Gas Journal*, v. 54, May 23, 1955, p. 107-110.
- Corrosion control measures include hydrogen sulfide removal and water washing procedures. Diagrams, tables, photograph. 9 ref. (R2)
- 241-R.** Corrosion Research Laboratories. III. The U. S. National Bureau of Standards. J. G. Thompson. *Corrosion Technology*, v. 2, Apr. 1955, p. 102-105.
- Investigates corrosion of metals in underground service, and in marine and other environments, with and without applied stress. Photographs. 20 ref. (R11)
- 242-R.** Corrosion Fatigue. E. A. Smith. *Aeronautics*, v. 32, May 1955, p. 40-42.
- Importance as a factor in safety considerations. Diagrams, graphs. 11 ref. (R1)
- 243-R.** Liquids of Metal-Oxide/V₂O₅ Systems. G. Lucas, M. Weddle and A. Precece. *Iron & Steel*, v. 28, May 1955, p. 264-267.
- Suggests approach to problem of heat resistant alloy attack by the development of alloys which would depend on some element, other than chromium, for their oxidation resistance, or by prevention of vanadium pentoxide reacting with the protective oxide film. Graphs. (R2, SS)
- 244-R.** Gas-Turbine Alloys. G. T. Harris, H. C. Child and J. A. Kerr. *Iron & Steel*, v. 28, May 1955, p. 268-271.
- Effect of the composition on resistance to scaling and to V₂O₅ attack. Graphs, tables. (R2, T25, SG-g, h)
- 245-R.** Effects of Aluminium and Manganese on the Resistance Against Atmospheric Corrosion of Some Copper Alloys. G. P. Chatterjee. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 211-221; disc., p. 221-222.
- Behavior of copper-zinc and copper-magnesium alloys with reference to atmospheric corrosion. Graphs, tables. 5 ref. (R3, Cu, Mg, Zn, Al, Mn)
- 246-R.** (German.) Contribution to the Problem in Intergranular Corrosion of Austenitic Chromium-Nickel Steel. Erwin Brauns and Günther Pier. *Stahl und Eisen*, v. 75, no. 9, May 5, 1955, p. 579-586; disc., p. 586.
- Plotting of "current-density-potential" curves of an unstabilized stainless steel after quenching and reheating to 650° C. for up to 192 hr. Diagrams, graphs, micrographs, table. 9 ref. (R2, SS)
- 247-R.** Electrical Grounding Systems and Corrosion. L. P. Schaefer. *Application and Industry*, 1955, no. 18, p. 75-81; disc., p. 81-83.
- Considers proper conduction of electric currents to the earth resulting in adequate grounding and conduction of currents through the earth resulting in corrosion or the prevention of corrosion. Diagrams, graph, table. 15 ref. (R1, R8)
- 248-R.** Underground Corrosion on Rural Electric Distribution Lines. O. W. Zastrow. *Application and Industry*, 1955, no. 18, p. 101-108; disc., p. 108-109.
- Studies of corrosion associated with grounding of multi-ground wye-connected distribution lines. Map, graphs, diagrams, photograph, table. (R1, R8)
- 249-R.** Exhaust Valve Corrosion in Gasoline Engines. C. H. Allen and M. J. Tauschek. *Automotive Industries*, v. 112, June 1, 1955, p. 52-55, 116, 118.
- Review of corrosion resistance of various valve steels. Graphs. (R3, AY)
- 250-R.** Metal Corrosion and Protection. II. R. R. Rogers. *Chemistry in Canada*, v. 7, May 1955, p. 38-41.
- Coating for iron, zinc, aluminum and magnesium; laboratory corrosion tests. Tables, graph, photograph. 16 ref. (R11, L general, Fe, Zn, Al, Mg)
- 251-R.** Corrosion in the Petroleum Industry. I. F. H. Garner and A. R. Hale. *Corrosion Technology*, v. 2, May 1955, p. 143-146.
- Reference to various types of operation in the petroleum industry. Photographs, table. 6 ref. (R7)
- 252-R.** How Carefully Do You Control Your Salt Spray Test? H. A. Holden. *Corrosion Technology*, v. 2, May 1955, p. 157-159, 163.
- Considers so-called "salt-fog" testing method. Tables, photograph. 14 ref. (R11)
- 253-R.** The Influence of Vanadium Pentoxide on the High-Temperature Scaling of Heat-Resisting Alloys. W. Betteridge, K. Sachs and H. Lewis. *Institute of Petroleum, Journal*, v. 41, May 1955, p. 170-180.
- Materials used; scaling without stress; effects of corrosion on high-temperature properties. Micrographs, tables, graphs, photographs. 7 ref. (R2, SG-h)
- 254-R.** Cathodic Protection With Zinc Anodes. (Digest of "Sound Application for Zinc Anodes," by A. W. Peabody; presented at the Thirty-Sixth Annual Meeting of the Ameri-
- can Zinc Institute, St. Louis, Mo., April 21, 1954.) *Metal Progress*, v. 67, June 1955, p. 172, 174, 176.
- Previously abstracted from original. See item 341-R, 1954. (R10, T general, Zn)
- 255-R.** Here's What They're Doing to Stop That Costly Corrosion in Refining Equipment. Gerald L. Farrar. *Oil and Gas Journal*, v. 54, June 6, 1955, p. 120, 123.
- Corrosion reactions, summary of refinery experience. Photographs. (R7)
- 256-R.** (German.) Causes of Corrosion. H. Grubitsch. *Chemie-Ingenieur-Technik*, v. 27, no. 5, May 1955, p. 287-298.
- Reports on tarnish and scale actions in the system metal-gas and thermodynamic treatment of corrosion actions. Diagrams, graphs, tables. 123 ref. (R general)
- 257-R.** (German.) Corrosion of Pipes and Protection Against Corrosion in Chemical Plants. H. Klas and G. Heim. *Chemie-Ingenieur-Technik*, v. 27, no. 5, May 1955, p. 299-307.
- Corrosion phenomena due to water, acids, lye solutions and gases and their causes. Measures for protection against corrosion, divided in three groups—active protection, application of protective coatings and selection of suitable materials for pipes. Diagrams, photographs, tables, graphs. 60 ref. (R5, R6, R9)
- 258-R.** (German.) The Development of the Cathodic Protection Against Corrosion of Metallic Construction Under Water and in Soils. J. Illovič. *Werkstoffe und Korrosion*, v. 6, no. 4, Apr. 1955, p. 181-189.
- Equipment and methods for protection of pipelines, pile-foundations, ships and electric cables. Table, diagrams, photographs. (R10)
- 259-R.** (German.) Cathodic Protection Against Corrosion in the Chemical Industries. W. Rausch. *Werkstoffe und Korrosion*, v. 6, no. 4, Apr. 1955, p. 189-196; disc., p. 197-198.
- Theory, materials and procedures for protection of pipe-lines, sluice-pipes, coolers, condensers and hot water tanks against corrosion by aqueous electrolytes. Graphs, diagrams, photographs. 6 ref. (R10)
- 260-R.** (Russian.) Resistance to Corrosion of Various Metals in Soda-Potash and Soda-Sulfate Solutions. V. G. Inzhchik and A. V. Ianush. *Khimicheskaiia Promyshlennost'*, 1955, no. 1, Jan.-Feb., p. 39-42.
- Laboratory and plant tests of corrosion rates, effect of temperature and covering atmospheres, comparative resistance of different steels and irons. Graphs, tables. (R5, ST, CI, NI)
- 261-R.** (Russian.) Corrosion Behavior of Multilayer Metallic Coatings. V. V. Romanov. *Zhurnal Prikladnoi Khimii*, v. 28, no. 5, May 1955, p. 475-479.
- Composition of electrolytes and manner of application. Electrode potentials in relation to time in solution of sodium chloride. Potential of chromium compared to that of Fe, Cu, Ni, Cr multilayer coating. Polarization curves. Graphs, photograph, tables, diagram. 7 ref. (R5, Li7, Fe, Cu, Ni, Cr)
- 262-R.** (Russian.) Effect of Temperature on the Corrosion of Metals by Chlorine. Kh. L. Tseitlin. *Zhurnal Prikladnoi Khimii*, v. 28, no. 5, May 1955, p. 490-496.
- Two groups of metals in terms of their resistance to dry chlorine at a high temperature. Release of heat during reactions. Special resistance

of lead despite its low melting point. Effect of chlorine contrasted to that of other gases. Table, graph, micrographs. 9 ref. (R6, Al, ST, CN, CI, AY, Cu, Ni, Pb)

S

Inspection and Control

92-S. Improving Casting Quality Through Non-Destructive Testing. Francis H. Hohn. *American Foundryman*, v. 27, May 1955, p. 96-100.

Equipment used to obtain quantitative information about steel casting quality which is then used to evaluate factors that might be responsible for deviations from the desired soundness level. Photographs, X-rays, radiograph, graphs, diagrams. (S13, CI)

93-S. Ultrasonics Makes Itself Heard. Peter K. Bloch. *Steel*, v. 136, May 16, 1955, p. 118-119.

Used as a thickness tester and to distinguish nodular from gray iron. Photographs. (S14, Fe)

94-S. Ultrasonic Inspection of Arc-Cast Zirconium and Its Alloys. F. W. Wood and J. O. Borg. *U. S. Bureau of Mines, Report of Investigations* 5126, Mar. 1955, 8 p.

The method may be used to delineate irregularities, inclusions, porosity or shrink holes in ingots up to 48 in. in length. Diagrams, photographs. (S13, Zr)

95-S. (German.) Nondestructive Testing With the Aid of Electric Induction Processes. W. Schirp. *Elektro-Post*, v. 8, nos. 8-9, Mar. 29, 1955, p. 234-237.

Principle of and equipment for detecting defects and sorting metals. Diagrams, photographs, micrographs, table. 11 ref. (S13, S10)

96-S. Gamma-Radiography in Oil Storage Installations. IV. C. C. Bates. *Atoms (British)*, v. 6, May 1955, p. 144-147, 150.

Health and safety precautions applicable in this type of work. New method of nondestructive testing enables very high standard of weld inspection to be achieved. Photographs. (S13)

97-S. Gaging of Plating Thickness Points to Automatic Inspection. *Automation*, v. 2, June 1955, p. 57-60.

Three new gages point to automatic inspection and process control applications. Photographs, diagrams. (S14, L17)

98-S. Quality Control—Use of Statistical Methods in Steel Industry. A. V. Sukhatme. *Indian Institute of Metals, Transactions*, v. 7, 1953, p. 123-133; disc., p. 133-136.

Some examples of the application of quality control which show that substantial results were achieved. Diagrams, graphs. (S12, D general, ST)

99-S. Industrial Applications of X-Ray Techniques. T. H. Rogers. *Institute of Radio Engineers, Transactions on Industrial Electronics*, PGIE-2, Mar. 1955, p. 20-26.

Used for industrial and flash radiography, fluoroscopy and thickness gaging. Diagrams, circuit diagrams, photographs. 6 ref. (S13, S14)

100-S. Carbon in Steel. A. P. H. Jennings. *Iron & Steel*, v. 28, May 1955, p. 208-210.

A review of physical methods of determination. 12 ref. (S11, ST)

101-S. Radiographing 620 Miles of Welded Pipeline. *Welding Journal*, v. 34, May 1955, p. 459-460.

Equipment, methods and problems in construction of 8-in. line in Alaska. Photographs. (S13, K general, CN)

102-S. (German.) New Possibilities in the Radiography of Steel. G. Lang. *VDE Zeitschrift*, v. 97, nos. 11-12, Apr. 15, 1955, p. 347-350.

Steel of considerable thickness can be inspected directly by using an image-amplifying tube instead of a fluorescent screen. Graphs, diagrams, photographs, table. 7 ref. (S13, ST)

103-S. (German.) Measuring Small Radiating Powers With Thermocouples. Fritz Hoffmann and Ulrich Schiley. *Zeitschrift für angewandte Physik*, v. 7, no. 3, Mar. 1955, p. 109-113.

Optical and electrical arrangements for measuring radiation in terms of microvolts. Diagrams, tables, graphs. 5 ref. (S19, S16)

104-S. (Russian.) Use of Radioactive Isotopes to Control the Homogeneity of Solid Bodies and Determine Linear Dimensions. M. B. Neiman. *Stanki i Instrument*, v. 26, no. 4, Apr. 1955, p. 1-5.

Application of xeroradiography; determination of corrosion, wall and coating thicknesses. Diagrams, graphs. 21 ref. (S19, S13, S14)

105-S. Isotopes and Metals Engineering. II. G. G. Carr-Harris. *Canadian Metals*, v. 18, May 1955, p. 22-26.

Use of radio-active tracers and radiography in design and production of metal products. Photographs. (S19)

106-S. Comparator for Gas-Turbine Blade Roots. L. W. Nickols. *Engineering*, v. 179, May 20, 1955, p. 625-627.

Principles of operation, features of the comparator, sensitive adjustment of strut length, rotating turret, setting and operating, measuring pitch of serration centers. Diagrams, photographs. (S14)

107-S. An Infra-Red Radiation Pyrometer. J. D. Harmer and B. N. Watts. *Journal of Scientific Instruments*, v. 32, May 1955, p. 167-170.

Principles, description, calibration, emissivity correction. Graph, photograph, diagrams. 7 ref. (S16)

108-S. (English.) Industrial Applications of Radioactivity. Torbjörn Westermark, Gunnar Aniansson, Lars-Gustaf Erwall and Knut Ljunggren. *IVA Tidskrift för Teknisk-Vetenskaplig Forskning*, v. 26, no. 3, 1955, p. 81-85.

Uses in flotation chemistry, thickness measurements with gamma rays, wear studies, other applications. Photograph. 13 ref. (S19, S14, Q9, B14)

109-S. (French.) New Application of Ultra-Sound in the Testing of Materials. J. Brigg. *Revue universelle des mines*, v. 11, ser. 9, Apr. 1955, p. 137-151.

Review of existing methods of nondestructive testing. Fields of application of ultrasonic methods. Photographs, tables, diagrams. 17 ref. (S13)

110-S. (German.) The Significance of Flow Phenomena in the Iron and Steel Industry. Michael Hansen. *Stahl und Eisen*, v. 75, no. 7, Apr. 7, 1955, p. 401-410.

Survey of fluid flow of fuels, air and other fluids in ducts, compressors and pumps. Diagrams, graphs, photographs, micrographs, table. 19 ref. (S18, D general, Fe, ST)

NATIONAL METAL CONGRESS NATIONAL METAL EXPOSITION

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T

Applications of Metals in Equipment

106-T. British Preferences for Metals in Refinery Equipment. (Digest of "Metals in Oil Refining," by I. H. Thomas; *Journal of the Birmingham Metallurgical Society*, v. 34, June 1954, p. 51-70.) *Metal Progress*, v. 67, May 1955, p. 134, 136, 138, 140.

Metalurgical tests of materials used for refinery equipment in Great Britain. (T28)

107-T. All-Steel Network Grounds Substation. Glen Appleman and S. J. Litrides. *Electrical World*, v. 143, May 2, 1955, p. 59-61.

Details and advantages of all-steel grounding system. Diagrams, photographs. (T1, CN)

108-T. Inclined Hangers as Bridge Stiffeners. E. M. Rensa. *Engineering Journal*, v. 38, May 1955, p. 615-619.

Studies of design analysis of arches with inclined hangers. Diagrams. 8 ref. (T26, ST)

109-T. Aluminum in Railroad Equipment. G. B. Hauser. *Modern Metals*, v. 11, May 1955, p. 33-34, 36-37.

Applications of aluminum alloys in rolling stock and other equipment. Photographs. (T23, AL)

110-T. New Aluminum Bus Conductor. *Modern Metals*, v. 11, May 1955, p. 38-39.

Mechanical, physical and forming properties. Tables, photograph. (T1, AL)

111-T. The All-Aluminum Dyna-Panhard. *Modern Metals*, v. 11, May 1955, p. 59-62, 64.

Applications and advantages of aluminum alloys in light-weight French automobile. Photographs. (T21, AL)

112-T. (German.) Contact Materials on Silver Base With Special Consideration to Their Heat Treatment. W. Rienäcker, H. Spengler and H. Dittler. *Elektro-Post*, v. 8, no. 10, Apr. 8, 1955, p. 157-160.

Hardness and other properties of silver and silver alloys as a function of degree of deformation and heat treatment. Tables, graphs. 15 ref. (T1, J general, Q general, Ag, SG-R)

113-T. Many Applications for Aluminum in Automatic Drives. Joseph Geschelin. *Automotive Industries*, v. 112, May 1955, p. 62-64, 130, 132.

Use of die cast aluminum parts in the automobile industry. Photographs. (T21, AL)

114-T. Economics of Aluminium Sheet as Cladding for Industrial Buildings. *Engineer*, v. 199, May 20, 1955, p. 694-696.

Thermal transmittance of corrugated aluminum sheeting. Results considered on an economic basis. Photographs, tables, diagrams. (T26, AL)

V

Materials General Coverage of Specific Materials

115-V. The Coppers. XI. *Copper & Brass Bulletin*, 1955, May, no. 173, p. 8-9.

Composition and properties. Photographs, table. (Cu)

154-V. How Users Benefit From Pearlitic Malleable Castings. G. B. Mannweiler. *Iron Age*, v. 175, May 19, 1955, p. 111-114.

Cast pearlitic alloys cover a wide range of strength and hardness values, can be heat treated to meet service conditions, offer excellent machinability, good surface finish and intricate, close tolerance castability. Micrograph, graph, photographs. (CI)

155-V. Some Recent Developments in Stainless Steels. J. I. Morley. *Iron & Steel*, v. 28, May 1955, p. 183-188.

Heat treatment, mechanical properties, structure of precipitation-hardening chromium-nickel steels. Advantages and disadvantages of cold worked stainless steels. Tables, graphs, micrograph. 8 ref. (SS)

156-V. Metallurgical Properties of Silver-Cadmium-Copper-Zinc Brazing Alloys. Karl M. Weigert. *Welding Journal*, v. 34, May 1955, p. 421-424.

Formation and physical properties of metallurgical phases. Graphs. 9 ref. (SG-F)

157-V. (Polish.) Low-Alloy Construction Steels With Boron Addition. S. Wojciechowski. *Hutnik*, v. 22, no. 1, 1955, p. 23-30.

Survey of Russian, English and German, and native articles on contemporary production, chemical analyses of various boron steels, their uses and effect of boron on hardenability. Tables, graphs. 24 ref. (AY)

158-V. Ternalloy 5. Aluminum Casting Alloy. *Alloy Digest*, no. Al-27, June 1955.

Composition, physical constants, properties, heat treatment, machinability, castability, weldability, corrosion resistance, specification equivalents and applications. (Al)

159-V. Chromium Carbide Grade 608. Heat and Wear Resistant Alloy. *Alloy*

Digest, no. Cr-1, June 1955.

Composition, physical constants, properties, fabricating, joining, corrosion resistance, heat resistance and applications. (Cr)

160-V. Max-EL 1-B Machinery Steel. *Alloy Digest*, no. CS-3, June 1955.

Composition, properties, machinability, workability, weldability, heat treatment and applications. Graphs. (CN)

161-V. Phosphor Bronze. High Strength, Corrosion Resistant Alloy. *Alloy Digest*, no. Cu-27, June 1955.

Composition, physical constants, properties, heat treatment, machinability, workability, weldability, corrosion resistance, specification equivalents and applications. (Cu)

162-V. Chlorimet No. 3. Acid Resistant Alloy. *Alloy Digest*, no. Ni-19, June 1955.

Composition, physical constants, properties, machinability, weldability, heat treatment, corrosion resistance and applications. (Ni)

163-V. Allegheny Metal 25-20B. Heat & Corrosion Resistant Steel—Type 314. *Alloy Digest*, no. SS-30, June 1955.

Composition, physical constants, properties, heat treatment, machinability, workability, weldability, corrosion resistance, specification equivalents and applications. (SS)

164-V. Uniloy 1420 WM. Corrosion and Heat Resistant Steel. *Alloy Digest*, no. SS-31, June 1955.

Composition, physical constants, properties, heat treatment, machinability, corrosion resistance, scale removal, forgeability, weldability and applications. (SS)

165-V. Ottawa—60. High Vanadium Die Steel. *Alloy Digest*, no. TS-34, June 1955.

Composition, properties, heat treatment, critical temperatures, machinability, workability and applications. (TS)

166-V. Metallurgical Developments in Copper-Based Alloys. J. S. Vanick. *Foundry*, v. 88, June 1955, p. 96-99.

Alloy compositions, properties, foundry practice. Photographs, tables. 4 ref. (E general, Cu)

167-V. Selenium Data. J. D. Sergeant. *U. S. Bureau of Mines, Information Circular* 7715, Apr. 1955, 29 p.

Physical and chemical properties, geology and mineralogy, geographic distribution and foreign production, domestic production, consumption and foreign trade. Tables, graph, map, diagram. 192 ref. (Se)

168-V. (Dutch.) New Points of View on Alloyed Types of Structural and Machine Steel. André Michel. *Métaux*, v. 10, no. 8, Apr. 30, 1955, p. 103-109.

Development of low alloyed construction steels; use of chromium, nickel and molybdenum; need for research on new steels and heat treatment methods. (AY)

169-V. (French.) Magnesium-Zirconium Alloy Castings in Aircraft Production. M. R. Pradeau. *Technique et science aéronautiques*, v. 1, 1955, p. 23-29.

Chemical composition, crystal structure and mechanical properties, fields of application. Tables, graphs, photographs. 6 ref. (T24, Mg)

170-V. (Book.) Boron Steels—Production and Use. Technical Assistance Mission No. 124. 140 p. 1954. Organization for European Economic Cooperation, 2, rue André-Pascal, Paris.

Manufacture and application of boron and other low-alloy steels. Summary of the discussion between European and U. S. experts. (AY)

171-V. (Book.) Magnesium Laboratory Methods. 146 p. 1955. Dow Chemical Co., Midland, Mich.

Physical and mechanical testing, metallographic examination, chemical and spectrographic analysis, radiography. (P general, Q general, M21, S11, S13, Mg)

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Invitation to Entrants . . .



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Awards and Other Information

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of \$100, will also be awarded the exhibitor whose work is adjudged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's National headquarters in Cleveland.

All photographs may be retained by the Society for one year and placed in a traveling exhibit to the various Chapters. They will be returned to the owners in May 1956 if so desired.

Classification of Micros

BLACK AND WHITE PRINTS

1. Carbon and alloy steels
2. Stainless steels and heat resisting alloys
3. Iron, cast and wrought
4. Aluminum, magnesium, beryllium, titanium and their alloys
5. Copper, nickel, zinc, lead and their alloys
6. Metals and alloys not otherwise classified
7. Series showing transitions or changes during processing
8. Welds and other joining methods
9. Surface phenomena
10. Results by unconventional techniques (other than electron micrographs)
11. Slags, inclusions, refractories, cermets
12. Color micros (prints; no transparencies accepted)

Rules for Entrants

- Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable. Photographic prints shall be mounted on stiff cardboard; maximum dimensions should be limited to 15 by 22 in. Heavy, solid frames are not permissible because of difficulties in mounting the exhibit. Entries should carry a label on the face of the mount giving:
-
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-
-

Classification of entry

- Material, etchant, magnification
- Any special information as desired

The name, company affiliation and postal address of the exhibitor should be placed on the BACK of the mount.

Transparencies will NOT be accepted.

Entrants living outside the U.S.A. should send their micrographs by first-class letter mail endorsed "Photo for Exhibition—May be opened for customs inspection." To be acceptable as first-class mail the package should measure no more than 35 x 45 cm. (14 x 18 in.)

Exhibits must be delivered before Oct. 10, 1955, either by prepaid express, registered parcel post or first-class letter mail, addressed to:

A.S.M. Metallographic Exhibit
National Metal Exposition
Convention Hall
Philadelphia 4, Pa.

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October 17 to 21, 1955

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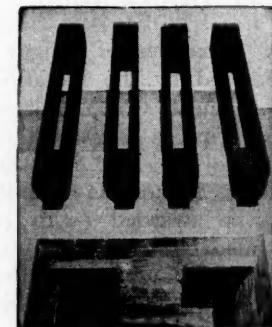
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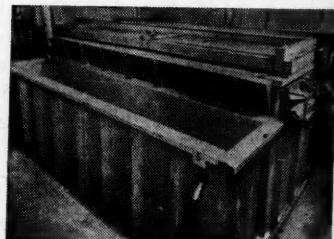
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